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AMERICAN JOURNAL OF ORTHODONTICS

and Oral Surgery.

OFFICIAL PUBLICATION OF
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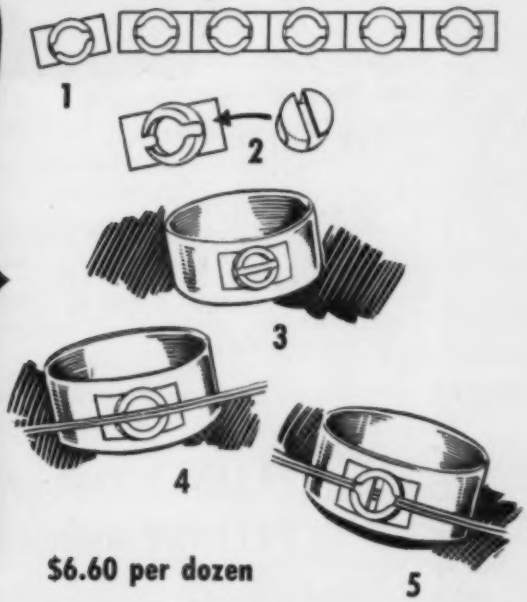

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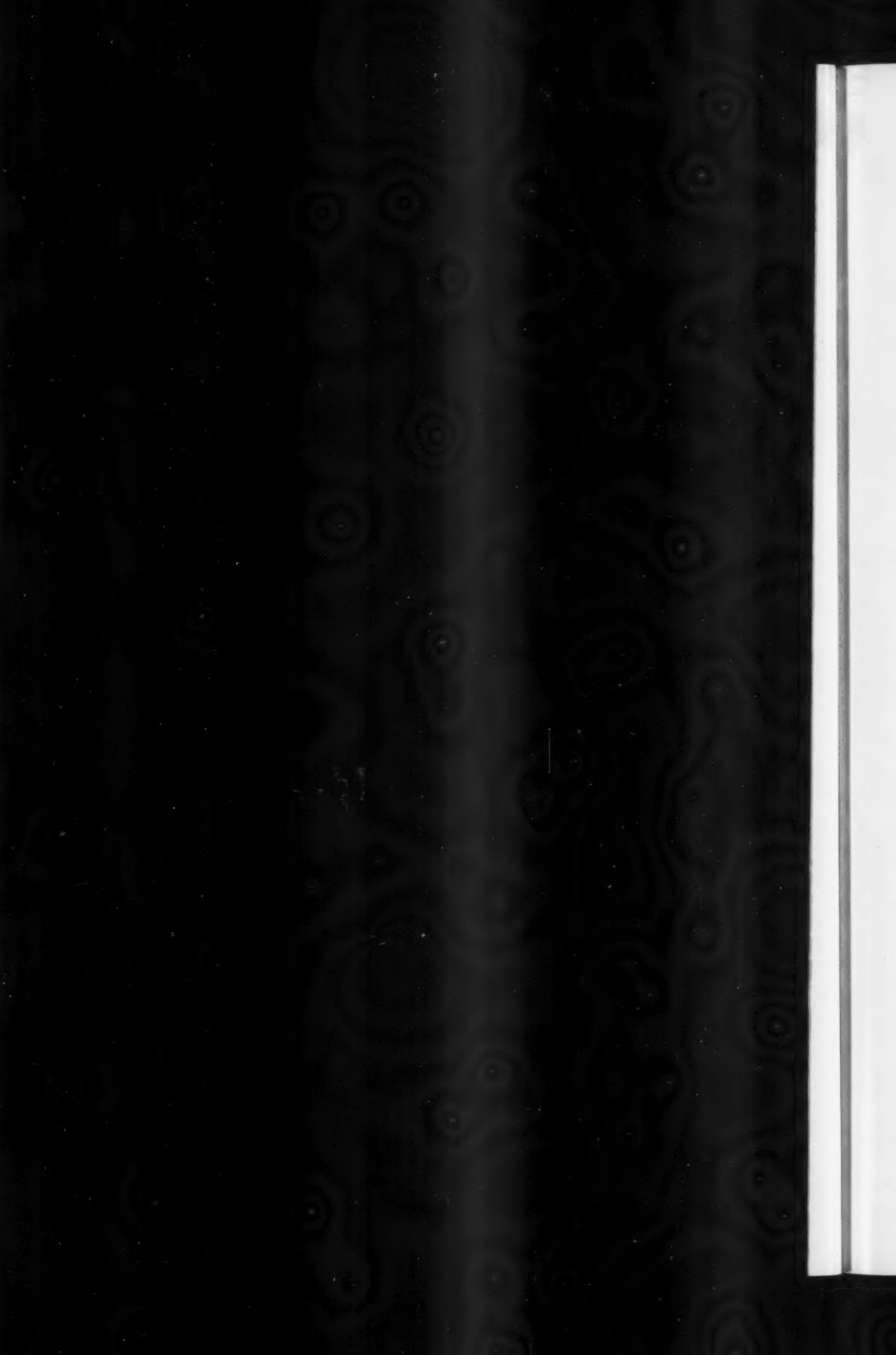

American Journal
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VOL. 34 JULY, 1948 NO. 7

Original Articles

PRESIDENT'S ADDRESS

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

R. E. OLSON, D.D.S., WICHITA, KAN.

THE first meeting of the Southwestern Society of Orthodontists was held in Dallas twenty-eight years ago. We are the second oldest orthodontic society that is a component of the American Association of Orthodontists. We owe our founders, friends, and members a debt of gratitude for their keen vision in the development of our specialty and for their labors in our organization.

No organization can continue to advance on a sound basis except in proportion to its desirable accomplishments. Many orthodontic organizations were fortunate in having as their founders members of the dental profession who worked in the advancement of scientific research, and strove for the proper organization of its membership. The Southwestern Society had such founders. We are happy that a goodly number of those pioneers are still with us and continue to work for the public welfare and for the improvement of our profession and organization.

The Southwestern Society has earned a desirable reputation for its progressiveness in the advancement of orthodontics and for the promotion among our members of fraternal relationship. Orthodontists have applied for membership in our organization from the boundary line of this society, without any solicitation on the part of our membership. We should continue in the taking of extreme care not to solicit membership from the boundary line of our territory. All sectional orthodontic societies, components of the American Association of Orthodontists, are striving for the same objectives as our organization. Perhaps they are more successful than we.

In the year 1881, one of the great teachers in orthodontics and an administrator of organized dentistry was born in Wichita, Kansas, the late Dr. Martin Dewey. He was graduated from a Wichita Normal School. Dr. Dewey attended

Presented at the meeting of the Southwestern Society of Orthodontists, Wichita, Kan., Feb. 2, 1948.

many of our meetings. I have a feeling that if he were living he would be attending this meeting today, and taking an active part in its scientific program. His body lies only a few miles from here, but his spirit will be with us. Directly or indirectly, at least a part of the scientific knowledge gained by members of this society was received through Dr. Dewey's efforts. For many years before her death, his beloved mother resided in this city. She also showed keen interest in the dental profession, and nearly every year the Kansas State Dental Association received flowers from her as a token of her interest and love for Martin's friends.

During the past year the "Grim Reaper" took from us our beloved member, Dr. Bryan James McGinnis. Due to illness he was unable to attend our last meeting; it was at this meeting that we heard the sad report of his passing. We shall miss Dr. McGinnis's companionship and his contributions to orthodontics and to our society.

My immediate predecessor advocated that, along with the pediatrician and eye, ear, nose, and throat specialists, we should sponsor legislation for excused school absences for dental and medical appointments. He recommended that the Public Relations Committee take action to bring about such legislation in the Southwestern states. The committee reporting on the President's address agreed that proper steps should be taken, and suggested that the problem be placed in the hands of the Public Relations Committee. This committee will give a report at one of our sessions.

We wish to have the objectives of his proposed legislation accomplished. Some think that those ends can be gained in their own state without sponsoring legislation; others feel we should have legislation *and* an educational program.

It is impossible to render proper orthodontic services if one must treat patients only after school hours and on Saturdays. Under such limitations the orthodontist cannot treat many cases, and his fees would have to be raised. We must educate the parents to the fact that it is more important to their children's future health, happiness, and success in life to have normal occlusion than to receive the highest grades in their school subjects. Also, the orthodontist must cooperate by trying not to have patients miss those classes which they find most difficult; and he must do his utmost in getting patients to return to school after they have received treatment. An appointment slip, given the teacher in charge, that shows the hour when the patient arrives and leaves the orthodontist's office, is appreciated by the school authorities. Then, too, it is recognized that the orthodontist in a large city is confronted with a problem of transportation that does not affect the doctor in a small city. We cannot expect the teacher to give children grades they do not deserve, but we should demand that they not penalize children for missing classes while at the doctor's office.

Patients tell me they have no trouble being excused from school when their dental appointment card is presented, but that the teacher in charge often gives them a look of disgust. This frightens the child to such an extent that he does not wish to be excused. Legislation alone will not eradicate the attitude of some instructors, but educating the instructors and school authorities to the

value of correct occlusion will. In many cities, committees composed of representatives of the dental and medical organizations have met with school officials and reached agreements satisfactory to all.

If one cannot receive the cooperation of local school authorities through education and by meeting with them and discussing the problem, then those interested should have legislation enacted in their states, authorizing the excusing of pupils from school for dental appointments. The State of California enacted a law in June of 1939. It provides that, "No absence of a pupil from school for the purpose of having dental services rendered shall be deemed an absence in computing the average daily attendance." It took four years of struggle against the opposition of the State Department of Education before this law was passed. The Southwestern Society of Orthodontists should give financial or any other possible aid in helping any state within our boundaries enact such legislation if other methods have failed to gain the cooperation of the school authorities.

The medical profession has been fortunate in receiving large sums of money by which it can support research programs. The majority of investigators in orthodontics labor at a great sacrifice to themselves. Various members of our society are personally acquainted with individuals in this great Southwestern country who financially sponsor worth-while projects. If those philanthropists were shown the benefits of orthodontic treatment by our members, I am sure that some of their financial support to worthy causes could be diverted toward research in our branch of dentistry. Scientific findings of today become the methods of practice tomorrow. We should do everything possible to encourage those who are interested and capable of working in the field of orthodontic research. During this meeting we shall hear a report from one of our committees that will show our organization's plan to encourage the worthy graduate student in our field of science. However, I doubt if the essayists, whom you will have as your teachers during this meeting, needed much encouragement in their work, except knowing that they were headed in the right direction toward proving their convictions. Even though Dr. Clinton C. Howard has retired from active orthodontic practice, he continues to devote many hours of work in finding out more about the complex biologic fundamentals of orthodontics.

During the last World War many young men were required to have their orthodontic appliances removed before treatment was completed, and you know the results. Some orthodontists have stated that they thought orthodontic treatment should have been continued in the service. If the patient was stationed in the United States in a locality where orthodontic treatment could be rendered by an orthodontist in the service or by a civilian orthodontist, then that would have been true. It certainly would not have been fair to permit the boy who had orthodontic appliances on his teeth when he entered the service to remain in the United States, and the less fortunate boy who in civilian life did not have orthodontic treatment started sent into combat area.

A goodly number did as I did—treated, advised those who were wearing appliances, or removed appliances. We realize that there were many reasons why proper orthodontic treatment could not be rendered in the service in time of war.

I wish to make the recommendation that the Southwestern Society of Orthodontists instruct, at this meeting, its delegate to the American Association of Orthodontists to discuss with the directors of that body at the next annual meeting, or sooner, the advisability of the American Association of Orthodontists requesting or recommending to the proper authorities in the United States Government, at an opportune time, the following: That provisions be made for proper orthodontic treatment for those entering the services while under treatment, if universal military training be enacted. I do not think we should wait until we have universal military training to make such a recommendation to our central body.

Last year our president, in his address to this society, paid tribute to the members of the Southwestern Society who served in the armed forces during the last World War. In behalf of those who served in the armed forces, I wish to pay tribute to you who were not able to serve with us. We are mindful of the service you gave our great nation on the home front. No war can be won without such support.

Some years ago, certain professional periodicals advertised laboratory-made appliances with diagnostic plans. This was a service of little or no value to the patient in need of orthodontic treatment; often the treatment rendered more harm than good. Those interested in seeing the public receive the best in orthodontic diagnosis and treatment owe a vote of gratitude to those who campaigned for the abolishment of undesirable advertising in dental journals. However, there are orthodontic laboratories in business today. Not many weeks ago I received a letter from a laboratory advertising that if I would send models and x-ray pictures of the area where deciduous teeth were in place, they would diagnose the case and appliances would be constructed. We know that most of the patients being treated in our offices at this time would not receive proper care if we used such meager material from which to render our diagnosis and treatment. It would be well if all state dental acts defined the practice of dentistry in terminology that would, with their specialist section and with other sections of their dental act, eliminate the undesirable methods of the orthodontic laboratory. Also, those same laws would protect the public from dentists who wish to announce their limitations to any dental specialty of practice without giving satisfaction before a special examining board as to their qualifications. We should work for legislation that would be of benefit to the public.

Our state and national legislative bodies often react in favor of the side having the greatest power in organization. Although our society is not large in its number of members, our officers should use the prestige of our society's name in supporting desirable legislation, even though it be a duplication in effort of state or national dental societies.

You have undoubtedly been reading and studying the articles in the *Journal of the American Dental Association* regarding the action taken by the Council on Dental Education in proposing jurisdiction over the educational requirements for the specialties. The Board of Directors of the Southwestern Society of Orthodontists, in regular session on July 20, 1947, protested part of the action

taken by the American Dental Association's Council. Your Board of Directors sent the Council a resolution (which you have undoubtedly read), and a representative of the Southwestern Society of Orthodontists met with this American Dental Association Council at Boston. We will have the privilege of hearing a detailed report on this matter at a later session of this meeting. It is your duty to attend and to take an active part in its discussion. No Council serving for the American Dental Association wishes to force its wishes upon those practicing our specialty, but we should make sure that we are correct in our desires, make them known, and strive for their adoption.

The public is being slowly educated to the value of dental care through a constructive use of propaganda by various manufacturers, and through the educational programs of public health departments and dental organizations. Have you observed how little stress in those efforts has been placed on the prevention of malocclusion? However, it is appreciated that various dental organizations and public health departments have started to teach more preventive dentistry.

Many years ago there were only private educational institutions. Our present free public school system came when our people recognized the fact that education is a prerequisite to well-ordered lives in our modern society. We now have laws requiring children up to a certain age to attend school regardless of their financial status. In time, will the public come to demand that indigent children receive orthodontic treatment through taxation on the basis of an added social responsibility? In time, yes—say a generation, but a generation is a lifetime. It can be a tragic lifetime for thousands of American children whom fate has touched with distorted features, a lifetime in shadows and gloom. Yes, the problem here involves the challenge that even the humblest child in our land should not suffer through lack of orthodontic treatment or treatment that would prevent malocclusion. I think that the challenge can be met without a bureaucratic form of socialized dentistry!

Here let me inject a word of caution. Unfortunately, during the past several years officials in Washington, through innumerable relief measures, have encouraged our people to think that if they need aid of any nature it should and will come from the government .

We have seen in our own state how dental examination of school children and the distribution of dental literature bring children to our offices. Many of the parents of these children state that they are unable financially to have treatment. If you will investigate those cases, you will find that most of them have money for nearly everything but medical or dental care. May I remind you that, using business standards in determining equitable profits, our fees in this section are low.

It is not, then, always a case of parents being unable to pay an orthodontic fee. Too often it is the case of parents unwilling to part with nonessentials. Here again is involved the lack of health education that makes luxuries more important to short-sighted parents than the benefits to be derived from orthodontic treatment of their children. This attitude of parents is not difficult to

understand when we reflect upon the high-powered methods employed by manufacturers who for many years have so advertised their products that in the minds of the public luxuries and nonessentials have become very essential to their comfort and happiness. We cannot, of course, educate our public away from the use of nonessentials and luxuries. However, the task should not be too difficult to educate a parent on the logic, the wisdom, the humanity of placing a few items back upon the shelf of luxuries in exchange for the normal life of a child.

It is not a question of whether we shall continue a program of dental health education. Is it not, rather, a question of how we can strengthen and broaden that program? Let us take a leaf from the evolution of our public school system. Do you not recall reading that many of the warmest, the most influential supporters of that cause were childless people? Every community is a neighborhood; and the heart of every member of a community goes out to the afflicted child of a neighbor. Bring home to the conscience of the American people the true economic and social value of preventive and corrective orthodontics, and a battle is won.

Every orthodontist must do everything in his power to educate the public. Of course, the orthodontists alone cannot carry the full burden of the program. None of us could spare the time from our practice to direct such a strenuous and complex campaign. Then, too, we cannot be expected to carry the financial burden involved, for we have families to support. However, I think the day will come when the Southwestern Society of Orthodontists will want to employ an executive, under its supervision, to attend to such guidance work; for in a final analysis our activities in the campaign, individually and collectively, must be limited largely to a directive capacity.

A modern, progressive, scientific public dental health education, disseminated by all state and local public health departments, and through the curricula of all school systems, under the guidance of ethical dental organizations—this should be one of our objectives. To this end, then, let every orthodontist bend his individual efforts; and toward the consummation of this ideal, let the full collective power of orthodontic organizations be directed.

In the meantime, let us not ignore our domestic responsibility, so to speak, as we go about keeping our house in order. To this end may I offer some observations and suggestions.

Some do not trust public health authorities. It is for the dental organizations in each state to attend to securing or keeping in the dental division of their boards of health only personnel of desirable qualifications.

I think that many of the public health authorities are in favor of some form of socialized dentistry without the elimination of private practice. A few of those plans are worthy of our consideration. They are doing a great amount of good in their preventive programs, and we should extend to them the best of our cooperation in that field of endeavor.

We are not opposed to any legislation that would be in the best interests of the American people. However, we should take caution in supporting legisla-

tion or programs that appear desirable for their humanitarian benefits to indigent individuals, which in the long run would only be a steppingstone for legislation harmful to the majority of the people.

Mass production cannot be applied to orthodontic treatment; but the indigent with extreme cases of malocclusion should be treated. They could receive treatment at our charity or tax-supported hospitals, at school clinics, or at other clinics. All such clinics should be under the supervision of ethical dental organizations. No orthodontist should render his services unless the majority of orthodontists in his area agree to the advisability of such service being given in any clinic. The compensation the orthodontist will receive should also be acceptable to those orthodontists. Those cases he treats in his own office would be his own affair, save when he accepts payment from any agency that seeks the lowest fee; then he should cooperate with the local orthodontists, or with those in his district.

All dental schools should give intensive courses in preventive orthodontics to their undergraduate and graduate orthodontic students. It would be splendid if physicians, medical students, and those taking nurses' training could receive preventive instruction.

The dentist in general practice should be instructed as to the means by which he can aid in the prevention of malocclusion. You know the method by which each group can receive such instruction. Last but not least, the orthodontist should practice those factors known to be an aid in the prevention of malocclusion in which he can participate.

That I may not be misunderstood, I realize that there are many factors in the etiology of dental and oral anomalies. At this time, there are no means by which we can prevent many of them.

Years have been added to the length of dental college courses; in some states the applicant must take two state board examinations, and various waiting periods are required before one can announce himself as being in the exclusive practice of orthodontics. Those are advancements that have been found necessary and desirable. However, all of those improvements have added thousands of dollars to the cost of preparation for practice.

When the time arrives for the discontinuation of the financial aid feature of the G. I. Bill of Rights, will there be many men enrolling in colleges for the purpose of studying orthodontics? I do not think there will be many. We should, therefore, encourage qualified men to study orthodontics.

We should encourage a more equitable distribution of orthodontists. During these times of prosperity orthodontists are busy, but when normal times return you will find localities with an overabundance of orthodontists, while in other sections there will be, as now, insufficient numbers. We cannot tell a doctor where he must locate, but we can advise the recent graduate to locate in areas where he is needed. He often has no idea of how to determine if a city needs an orthodontist, or an additional one. The advice "to locate where you would sooner live" is the easiest to give, but it does not help orthodontics or the public who need treatment.

I wish to express my sincere appreciation to the essayists and clinicians, the officers and committeemen who have served faithfully during my administration and in preparation for this meeting.

No profession offers greater opportunity for service than ours. We are all human, of course, and into the lives of all of us at times discouragement will come. When shadows cover our sun, let me recommend that we turn to the words of the late Dr. C. N. Johnson:

> The science of orthodontia came into the dental profession as a distinct benefaction. . . .
>
> And what a blessing it has all been! Think of the countless lives it has sweetened by its beneficence. It has freed humanity from one of its most glaring deformities, and has transformed the hideous imperfections of Nature into the essence of symmetry and beauty. It has waved the magic wand of its subtle art across the distorted features of little children, and lo, they have come forth perfect in the image of divinity. It has relieved the aching hearts of mothers, and added to the joy and pride of doting fathers. It has removed from budding youth the blight of prejudice, and destroyed the handicap which threatened to mar a human life.
>
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THE TREATMENT OF MALOCCLUSION

ALEXANDER SVED, D.D.S., NEW YORK, N. Y.

INTRODUCTION

IT GIVES me great pleasure to present a subject to you which has not been fully discussed in the past. I am very grateful for the privilege granted to me by the program committee of the Southwestern Society to bring this important subject before you, and I only hope that my presentation will help to clear up some of the complex orthodontic problems.

The title of my paper is somewhat misleading because I do not intend to show or describe how some specific types of orthodontic cases may be treated, but, rather, I wish to discuss orthodontic treatment in general and to analyze the response we may expect to the action of our appliances. The manipulation and action of appliances constitute treatment; therefore, in a broad sense the title of my paper adequately describes the subject matter to be presented. In a general discussion of treatment it is always assumed that the diagnosis is already made and that we know what changes must be brought about to establish normal relationships. The changes which may be dictated by diagnosis include:

1. Alignment of teeth.
2. Establishment of normal arch form.
3. Rotation of teeth.
4. Establishment of normal arch relationships.
5. Changes in the occlusal level.

For convenience, the treatment of malocclusion may be divided into active and passive phases. During the active phase the teeth are brought into proper alignment, rotated teeth are corrected, and normal arch forms are established. At the same time an attempt should be made to change disto- and mesioclusion of the teeth to normal occlusion by repositioning the mandible. During the passive phase, distoclusion may further be improved by the distal movement of the entire maxillary alveolar arch, and by an adjustment of the occlusal level. Furthermore, the tooth movements accomplished in the active part of the treatment may be effectively retained.

It is not clear just how much of the mesiodistal correction of arch relationship is due to the repositioning of the mandible and how much of it is due to the distal movement of the entire maxillary arch. We have reason to believe that in the correction of any orthodontic case both these changes do take place, but in different proportions in different individuals. Our cephalometric

Presented at the meeting of the Southwestern Society of Orthodontists, Wichita, Kan., Feb. 2, 1948.

and roentgenographic methods of measurements are not sufficiently refined to determine this accurately. Therefore, it becomes important to correct mesiodistal malrelations first by repositioning the mandible and later by the distal movement of the entire maxillary alveolar arch. Overcorrection in the first instance is not permanent and in the second instance it is not possible; therefore, the combination may give the maximum possible correction which may or may not be sufficient.

In the discussion of the active phase of treatment it is not necessary to describe how changes in tooth positions may be brought about. It is more important for us to study the behavior of the various types of appliances, and to discover the particulars in which they differ. This will enable us to understand better their mode of action, and to determine with accuracy their desirable properties. For this reason, in the first part of my paper I shall deal with the "Mechanics of Appliances," while in the second part I shall discuss the changes in arch relationship and the adjustment of occlusal level. The question of extraction must necessarily form part of this presentation.

Part I. Active Phase of Treatment

The Mechanics of Appliances

The alignment of teeth and changes in arch form can be brought about by different types of appliances. A large variety of labial appliances are in use at the present time, and many modifications of the lingual appliance are employed. It must be taken for granted that satisfactory results can be obtained by any one of these appliances. In most instances the choice of the appliance is determined by personal preference, close association with an accomplished operator, or a thoroughly mastered technique. Changing the method of treatment in a busy orthodontic office is extremely difficult, and it requires a tremendous effort. For this reason, orthodontists do not readily accept new methods of treatment. In my own practice I have used the labiolingual technique for eighteen years, and it required two years of real hard work to change to a multibanded appliance. This change became necessary in my office because I found that the plain labial and lingual appliances could not effectively produce some of the required tooth movements. They required too much personal service and too many visits for treatment. Furthermore, on account of the large number of visits, all patients arrived at the office after school hours. The schools would not excuse the children from attendance on the same afternoon each week because they would miss an entire subject of study during the year. As a result of this, the number of patients to be treated every afternoon became so large that I had no time to make the necessary additions to the labial and lingual appliances, such as bands, rotating arms, and springs, and at the same time take care of repairs. These operations were delayed for weeks and often for months. I solved this part of the problem at that time by making special appointments for repairs and extensive changes, but the difficulty was that I could not meet the emergencies as quickly as they arose. This meant a loss of time, and my practice reached a point of saturation beyond which it was not advisable or safe to go.

On June 2, 1925, Dr. Angle presented the edgewise arch mechanism to the Edward H. Angle Society of Orthodontists. Three years later, a full account of this new appliance was published in the *Dental Cosmos* under the title, "The Latest and the Best in Orthodontic Mechanism." This appliance gained in popularity and today, nearly a quarter of a century later, it is very extensively employed. In the beginning I did not accept any of the multibanded appliances, for I instinctively felt that with their use the tissues were unduly strained. This was confirmed by numerous case reports which showed extensive root resorptions, especially in the anterior regions of the reported cases. Yet there was something about the edgewise arch mechanism that could not be set aside. Together with other mechanical improvements over the ribbon arch and pin and tube appliances, Dr. Angle gave us the concept of the ideal arch. This was a radical departure in appliance manipulation during treatment. In all previous orthodontic appliances, the arch wire was bent to the malocclusal positions of the teeth, and during treatment its shape was gradually changed toward the normal. The concept of the ideal arch is just the reverse of this. The arch wire is always bent to its final shape before it is locked into the attachments at each visit. Repeated application of the ideal arch causes the malposed teeth to move toward their proper positions. The introduction of the ideal arch was a great improvement in the fundamental approach to treatment. Appliance manipulation was reduced to a minimum, and there was a great saving of time. Nearly all cases treated by the edgewise arch mechanism were completed in twelve to eighteen months, which was a revolutionary advance as compared with the three, four, five, or even six years of treatment with other appliances. Unquestionably, the edgewise appliance is more efficient than any other appliance used at the present time, and this accounts for its general acceptance.

It is unfortunate that such a powerful appliance is so readily accepted by the profession, and that it is used for the treatment of malocclusion without inquiring into its action. Of course, we must understand that we are going through a slow development, and that the science of the specialty is just beginning to take shape. We have no methods by which we can appraise the value of a new appliance, and we are still at a stage where we describe mechanical action in such terms as "toe hold," "picket fencing," etc. These are not scientific terms and they have no place in our literature. They serve to illustrate conditions which we are not able to describe in other terms. Since we cannot explain the action of our appliances, we are not aware of the powerful forces which they may deliver to the tissues.

Several years ago, I became acquainted with Prof. R. C. Brumfield of the Civil Engineering Department of Cooper Union. I discussed this problem with him, and we both agreed that the elastic arch as used in orthodontics represents a complex indeterminate system. This means that the stresses set up in the arch wire and the reactions of the teeth cannot be calculated by the usual methods employed in the mathematical solution of problems in mechanics. Such a system is called a redundant system. It so happened that Professor Brumfield was interested in the study of redundant systems and developed a

unique method for their mathematical solution. His original work was tested and approved at the University of Minnesota, and was subsequently accepted as correct by the American Society of Civil Engineers. Professor Brumfield was kind enough to give me a mimeographed copy of the book he has written on the subject, and to instruct me in the application of the "Theory of Transmission Coefficients" for the calculation of stresses in the arch wire during orthodontic treatment, and also the reactions of the teeth. We determined the average loading arrangement during treatment, and I calculated the reactions of the teeth to the action of a 0.022 by 0.028 inch rectangular gold wire as used in the edgewise arch technique. The results of my calculations showed that instead of ounces of pressure, seven or eight pounds of force were delivered to some teeth during treatment. When a gold wire 0.016 inch in diameter was used, the force on the teeth was only 13 per cent of that exerted by the edgewise arch. It must be noted here that the finely machined walls of the edgewise arch brackets were neglected, and only knife-edge contacts were figured. If the brackets were also taken into consideration, these figures would be very much higher. I was somewhat alarmed by these results, and after Professor Brumfield checked my calculations he suggested that the figures could be confirmed by a machine he had designed. With this machine, the reactions to the action of arch wires, loaded as assumed in the calculations, could be accurately measured. Subsequently, I read a paper before the New York Society of Orthodontists entitled "The Behavior of Arch Wires in Fixed Attachments," published in the INTERNATIONAL JOURNAL OF ORTHODONTIA AND ORAL SURGERY **23**: 683, 1937, in which the results of my calculations were recorded. At the same meeting, Professor Brumfield read his paper entitled "An Experimental Check on Edgewise Arch Computations," also published in the INTERNATIONAL JOURNAL OF ORTHODONTIA AND ORAL SURGERY **23**: 687, 1937, in which he confirmed the correctness of my calculations. Furthermore, in a clinic, the reactions of the teeth to the action of a 0.022 by 0.028 inch rectangular wire were measured, and they were found to be equal to the computed values. These figures were recorded more than ten years ago. They are completely forgotten, and the edgewise arch appliance is being used more and more extensively. Some operators even go to the extent of using especially designed ligature pliers, to make sure that the arch wire is tied very firmly in the brackets. The overloading of the teeth occurs with the use of other appliances also, and the question arises, "What can we do to correct it?"

To answer this question properly, we must analyze the action of our appliances in a scientific manner. We must become familiar with elementary mechanics and use its well-known principles to explain what happens when an orthodontic appliance is activated. To establish normal arch outline and to bring teeth into proper alignment, an orthodontic appliance must be able to perform the following tooth movements:

1. Labial or buccal.
2. Lingual.
3. Rotations.

The labial, buccal, and lingual movements can be easily produced by a properly directed push or pull on the teeth. Therefore, these tooth movements can be effected by either lingual or labial appliances. Essentially, there is no difference between a push or a pull; their character is the same. The only difference between a push and a pull is that the push is applied behind, while the pull is applied in front of the moving tooth. In mechanics we do not differentiate between them except that in the design of structural members it must be known whether a member is to resist compression or tension. When a force is applied to a tooth it does not make a particle of difference whether it is applied in front or behind it. The reaction of the alveolar tissues will be the same.

There is, however, a very great difference between the action of appliances and the manner in which force is delivered to the teeth. Since a force is characterized by its intensity, its direction of action, and its point of application, it becomes necessary for us to discuss these characteristics. We already know that it makes no difference whether the force is applied in front of or behind a moving tooth. Therefore, its point of application cannot be a factor in determining its character of action. Similarly, it can be shown that to direct a tooth toward its normal position the force must be applied in the same direction, whether it is of a greater or lesser intensity, or whether it is applied in front of or behind the tooth to be moved. It is clear, then, that in moving a tooth toward its normal position the direction of its motion and that of the acting force are always dictated by diagnosis, so that in every instance the intensity of the applied force determines its character of action. When a force is delivered to a tooth, the tooth transmits it to the supporting structures. Tooth movement in response to the applied force becomes possible on account of the inherent ability of the alveolar tissues to resorb and build up bone. Resorption is the response to pressure, while deposition of new bone is stimulated by tension. These processes may take place at different rates, depending upon the intensity of the force. But the rate of resorption is not in direct proportion to the intensity of the applied force. We know from practical experience that it requires a very slight pressure to move a tooth, and that it is not true that the greater the force the more rapid the tooth movement. Experience also teaches us that it is not good practice to apply forces of great intensity for the movement of the teeth. Such forces may bring about the breaking down of the alveolar tissues, and also cause root resorptions. It is, therefore, important for us to study the action of the various orthodontic appliances, so that we may avoid these untoward effects.

An orthodontic force may be of a greater or lesser intensity, so that we may deal with *small* and *large* forces. Since tooth movement cannot take place without resorption and deposition of bone, every tooth movement involves an alteration of the alveolar tissues. This alteration of the alveolar bone may or may not be extensive, depending upon conditions created by the applied force. We know from the studies of Oppenheim that normally the architecture of the cancellous alveolar bone is such that the spicules are arranged nearly parallel to the long axis of the tooth, to resist the occlusal stresses better. If

a continuous force is applied at right angles to the long axis of a tooth, as for example in labial or buccal movements, then the bone spicules rearrange themselves parallel to the acting force. When the force is discontinued and the tooth is retained in its new position, the architecture of the alveolar bone changes again, and the bone spicules rearrange themselves parallel to the long axis of the tooth. The response to the action of intermittent forces must necessarily be different. If a short period of action is followed by a long period of rest, we may expect that beyond the initial resorption in front of the moving tooth, no rearrangement of the alveolar structures will take place, so that the bone spicules will always remain parallel to the long axis of the tooth. There is no experimental proof to support this explanation, but if the buccal or labial force is quickly discontinued, we may reasonably expect that gross changes in architecture will not be necessary. In conformity with this explanation, the intermittent force is always to be preferred for orthodontic purposes, and experience seems to support this.

It is a well-established fact that all teeth move in function. During the mastication of food they have individual functional movements. When small orthodontic forces are applied to the teeth, they are displaced from their position of rest in proportion to their functional freedom. Large orthodontic forces displace the teeth beyond their normal functional displacement by compressing the periodontal membrane and bending the alveolar bone. If the intensity of the force is great enough, the circulation may be cut off from both the periodontal membrane and the gingival tissues. This is evidenced by the blanching of the tissues upon the application of force. Unfortunately, many appliances in use at the present time produce the previously described effects, with the resulting partial destruction of the periodontal membrane and the alveolar bone.

To understand the difference in the action of appliances, let us consider two light-gage parallel wires, *A* and *B*, passing between two supports (Experiment *No. 1*, Fig. 1). If a ligature is applied between the two wires to draw them together, then wire *A* is deflected exactly the same amount as wire *B*. A stainless steel wire 0.016 inch in diameter is suitable for this experiment. If we substitute a gold wire 0.040 inch in diameter for wire *A* (Experiment *No. 2*, Fig. 1.), then under the action of the ligature, wire *B* will be drawn toward *A* almost the entire distance between them. The deflection in wire *A* can be neglected without appreciable error. It is clear that for all practical purposes the 0.040 inch gold wire can be considered fixed in relation to wire *B*.

In a similar manner it can be shown that if wire *B* is replaced by a heavier wire instead of *A* (Experiment *No. 3*, Fig. 1), then wire *A* will become movable in relation to *B*.

Now if both wires are replaced by heavier ones (Experiment *No. 4*, Fig. 1), then the application of the ligature will cause only a very slight deflection, and the intensity of the force which may be applied depends entirely upon the strength of the ligature. A very interesting condition is to be observed after the removal of the ligatures. In the first experiment both wires will be permanently deformed, and they regain only a fraction of the distance between them before the ligature is applied. In other words, they do not return to their original

position. In the second experiment, wire *B* is also permanently deformed, and after the ligature is removed it regains only a fraction of the original distance between the wires. In the third experiment, wire *A* behaves similarly to wire *B* in the second experiment. In the fourth example, there is no visible permanent deformation of the heavy wires *A* and *B*.

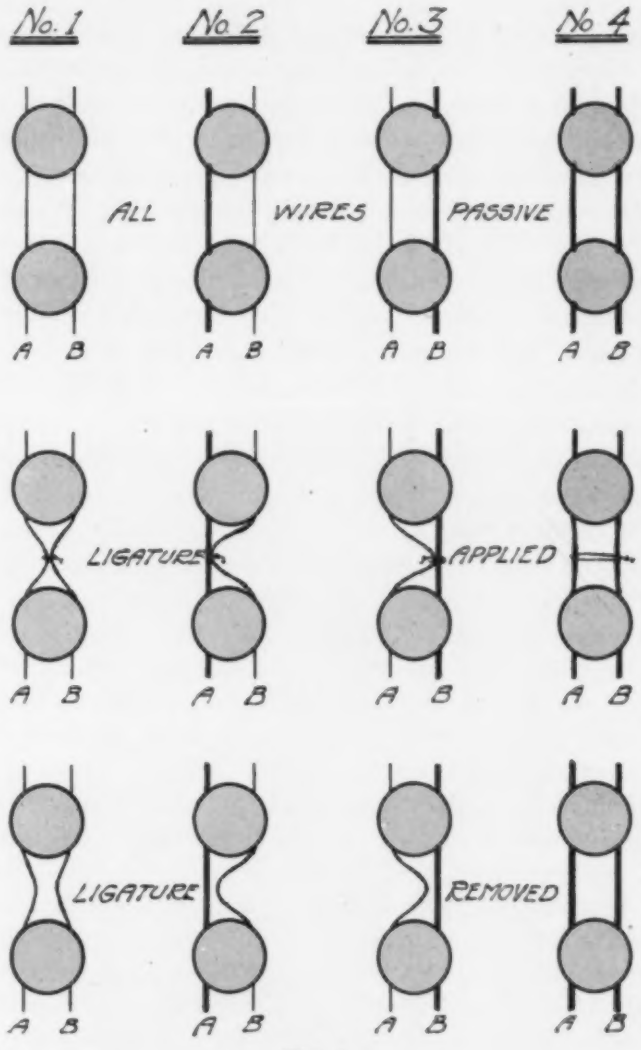

Fig. 1.

These experiments reveal very important characteristics of the appliances we are working with, and we must recognize the following:

1. A very large force may be delivered to a tooth if heavy arch wires are used. The intensity of the force is limited only by the strength of the ligature.
2. A heavy arch wire will not be deformed permanently by the application of large forces, and its elastic deformation is so small that it can be entirely neglected.

3. The intensity of force delivered to a tooth from a light arch wire is limited by the ability of the arch wire to resist bending stresses, and not by the strength of the ligature.
4. Light arch wires can be easily stressed beyond their elastic limit; therefore, they can be permanently deformed.

Here we have an extremely important difference between the use of heavy and light arch wires. In the case of heavy wires, the strength of the ligature determines the maximum intensity of the applied force, while in the case of the light arch wires the maximum force is determined by the ability of the arch wire to resist bending stresses. Translated into more practical terms, this means that with the use of heavy arch wires it is possible to overload a tooth by tightening the ligature, while with the use of the light arch wire the amount of force that can be delivered to a tooth is limited by the elastic properties of the wire, and the ligature cannot be tightened beyond a certain point. Attempts to tie the ligature tighter result only in a greater permanent deformation of the arch wires. This is a very desirable property which can be utilized during orthodontic treatment; it gives a comfortable factor of safety.

The strength of the ligature can be very easily calculated from the physical properties of the material from which it is made. Stainless steel has an ultimate strength of at least 60,000 pounds per square inch. This is a conservative figure. Using it as a basis of calculations, a wire 0.010 inch in diameter will break under a tension of 4.7 pounds, while a 0.008 inch wire will fail if loaded beyond 3 pounds. Here, again, it makes a great deal of difference how the ligature is applied. In the plain labial appliance, the ligature has a complex action. If the arch wire is in contact with the tooth which is ligated, there is no labial movement, but the ligature has a definite tendency to move the crown of the tooth mesially or distally, depending upon how the ligature is applied. Since it is desirable to give a mesial inclination to all anterior teeth, the ligature must be so applied that the distal strand passes occlusally, while the mesial passes gingivally of the arch wire. It can be shown that the rotating effect is produced by a couple formed by the ligature. The action of the couple will be taken up later. If the arch wire is not in contact with the tooth to be ligated, then the action of the ligature is entirely different. To understand this action, let it be assumed that the two strands of the ligature are cut by a plane x-x (Fig. 2). In order to maintain theoretically the pull on the tooth, we can replace the tension in each strand of the cut ligature by a force (F) equal to the tension. Each of these forces may be resolved into two components, one component in the direction of tooth movement and the other perpendicular to it. The sum of the components in the direction of tooth movement represents the total pull on the tooth. Since the maximum pull on the ligature may vary from 3 to 4.7 pounds, each of these components must be less than 3 or 4.7 pounds, so that the total pull on the tooth may reach an intensity of somewhat less than 6 or 9 pounds, depending upon the size of ligature used. In case of the 0.022 by 0.028 edgewise arch, the pull on the tooth is more direct and the total force may be as high as 9 pounds.

The important point to keep in mind is that there is only a negligible elastic deformation of the arch wire, and that the tooth is immediately forcefully displaced from its position of rest by these intense forces. The alveolar bone is also bent and the blanching of the tissues occurs. In the case of the labial appliance, this force is reduced as soon as a slight tooth movement takes place, and the injured tissues have an opportunity to repair themselves. In case of the edgewise appliance, this reduction of the force does not occur until a considerable tooth movement takes place, and the repair of the tissues is delayed. It must be pointed out, however, that the ligatures are never stressed to the breaking point and in case of the labial appliance we can estimate that the pull does not exceed 4 or 4.5 pounds. With the edgewise appliance, the ligature is stressed nearly to the limit by the use of especially designed ligature pliers. In the light of the facts just presented, the use of the ligature plier seems not to be permissible. It can be similarly shown that in all other appliances where heavy arch wires are used the application of ligatures or other locking devices may stress the alveolar tissues beyond their physiologic limit of endurance. The tooth movement is brought about by the forceful displacement of the tooth from its position of rest.

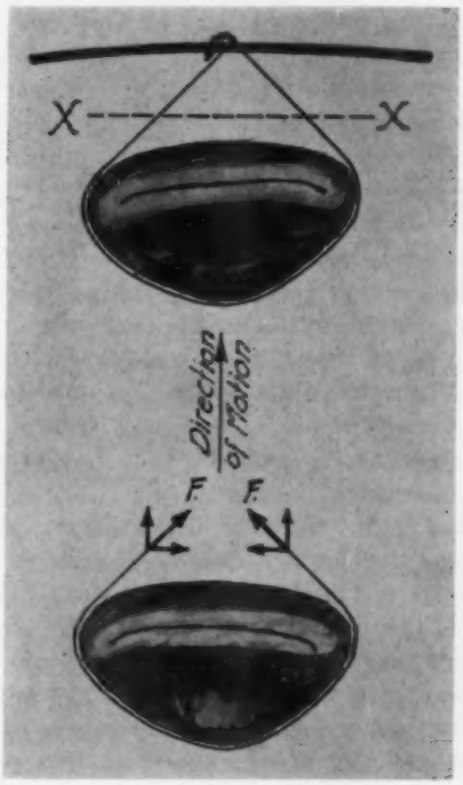

Fig. 2.

The use of light arch wires brings about an entirely different appliance action. It will be remembered that when a light arch wire is stressed beyond its elastic limit it becomes permanently deformed. This deformation is referred

to as the "permanent set" in scientific writings. If the ligatures were removed immediately after they were applied, the arch wire would have a residual spring, but it would not recover its original position. This is due to the elastic properties of the wire and to the permanent set. The residual spring acts through a comparatively short distance, but this distance is many times greater than the forceful displacement of the teeth by heavy arch wires. Thus, it is evident that while a heavy arch wire applies a greater force which acts through a short distance, the light wire applies a much smaller force which acts through a greater distance. Observation seems to bear out the fact that even with light arch wire the change in the position of the teeth takes place within twenty-four or forty-eight hours after adjustment, so that each treatment is followed by one or two days of tooth movement and an entire month of rest. The real important difference between greater and smaller intermittent forces is the effect on the periodontal membrane and the alveolar bone. The greater force shuts off the circulation of blood in the supporting tissues and may cause permanent injuries. When light arch wires are used, the amount of force which can be delivered to a tooth is always limited by the resistance of the arch wire to bending, which must necessarily be small.

From the foregoing it appears that a light wire used in fixed attachment is the appliance of preference. While such an appliance is not capable in itself of bringing about lateral expansion in the posterior region, it may be supplemented by a lingual appliance as for example in the Johnson technique; or the light wire may be followed by a heavy wire after the teeth are properly aligned, so that it may be locked into the attachments without undue strain. A 0.022 by 0.028 hard stainless steel wire may then be used to bring about expansion in the posterior region.

The type of attachment used is an important consideration. In the foregoing discussion it was assumed that the arch wires fit loosely in the brackets. When there is a close fit in the channel, secondary stresses are set up which may reach considerable proportions. On account of the length of the channel, even if light wires are used in the edgewise brackets, a turning effect is produced which brings about mesial or distal root movement. With the regular 0.022 by 0.028 rectangular wire, there may be a buccal or lingual turning effect which may move the root either buccally or lingually. These turning effects are spoken of as the "torque," which is assumed to be a very important part of the mechanism. It is my belief that these secondary turning effects are not beneficial. They complicate the appliance and unduly strain the teeth. The use of the arch-seating wrench and the ligature pliers in connection with the edgewise arch mechanism indicates that the stresses set up are much too great and that the appliance should be used with the greatest of care. I have pointed this out in a paper entitled "Principles and Technique of the Modified Edgewise Arch Mechanism," which was read before the New York Society of Orthodontists on Nov. 16, 1937. In order to remove these secondary turning effects, the edgewise arch bracket was modified. The slot in the original bracket was changed from a horizontal channel to a knife-edge slot, formed by two opposing wedges (Fig. 3).

This change was followed by a complete change in technique, and resulted in the development of a newer orthodontic mechanism, which as I stated at that time "gave me more satisfaction than any other appliance I have had the pleasure of using in nearly twenty years of practice." Today, after more than a decade, I again reaffirm that statement, and, with added experience and refinement of technique, I find it to be the most satisfactory all-around orthodontic mechanism.

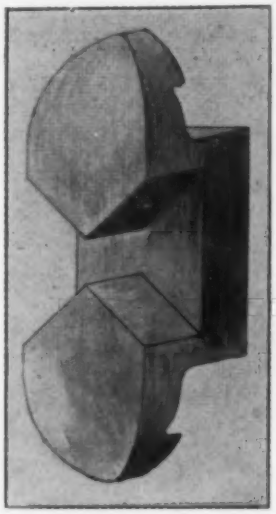

Fig. 3.

The alteration of the original edgewise bracket was the beginning of a new appliance. It is true that on first glance this appliance seems to be the same as the edgewise mechanism, but that is due to the use of bands on all teeth. The bands serve merely as a means for the attachment of the brackets to the teeth. They form a part of all appliances where brackets are used, and a variation in the design of the attachments invariably produces a new appliance. Just as Dr. Angle gave us the pin and tube and ribbon arch appliances before the edgewise mechanism, so other appliances were developed, such as the Johnson twin wire appliance and the modified edgewise mechanism. In all these appliances bands are used as a means of securing the brackets onto the teeth, and the difference lies in the design of the brackets. With different bracket designs, different techniques had to be developed, and there is no close relationship between the original edgewise arch mechanism and the modified edgewise appliance. The method of treatment is different, and it is based on the requirements I have just discussed. It is certain that the modified edgewise appliance is the most gentle of all appliances in use at the present time. When compared with the Johnson twin arch, which is the gentlest of all other appliances, it will be found to produce approximately one-half the pressure under the same conditions (Table I).

The most important feature of the modified edgewise appliance is that the intensity of the force applied to the teeth is automatically limited by the size of the arch wire used. Furthermore, it affords a mechanically perfect control

of tooth movements. The labial, lingual, and buccal tooth movements are very easily produced, and rotations are also accomplished very efficiently without the danger of overloading the teeth at any time. In order to understand the mechanics of rotation we must study the action of a couple. A couple is defined as "a system of two equal and parallel forces acting in opposite directions." These two forces are coplanar, or in other words they are in the same plane.

TABLE I. THE RATIO OF THE $\frac{"I"}{C}$ DIFFERENT SIZE WIRES TO THE $\frac{"I"}{C}$ OF THE JOHNSON TWIN ARCH

DIMENSION OF WIRE	SECTION	$\frac{I}{C}$ FORMULA	$\frac{I}{C}$ SECTION MODULUS	RATIO OF $\frac{I}{C}$ TO $\frac{I}{C}$ OF JOHNSON
Johnson 0.010		$\frac{5\ \pi d^3}{32}$	0.000000491	1
0.010		$\frac{\pi d^3}{32}$	0.0000000982	0.20
0.011		$\frac{\pi d^3}{32}$	0.000000131	0.27
0.012		$\frac{\pi d^3}{32}$	0.000000173	0.35
0.013		$\frac{\pi d^3}{32}$	0.000000216	0.44
0.014		$\frac{\pi d^3}{32}$	0.000000269	0.55
0.015		$\frac{\pi d^3}{32}$	0.000000332	0.68
0.016		$\frac{\pi d^3}{32}$	0.000000401	0.82
0.017		$\frac{\pi d^3}{32}$	0.000000483	0.98
0.018		$\frac{\pi d^3}{32}$	0.000000572	1.16
0.019		$\frac{\pi d^3}{32}$	0.000000675	1.37
0.020		$\frac{\pi d^3}{32}$	0.000000785	1.59
Rectangular 0.022 by 0.028		$\frac{db^2}{6}$	0.000002258	4.60
Rectangular 0.022 by 0.028		$\frac{bd^2}{6}$	0.000002875	5.84

This follows directly from the proposition in plane geometry which states that "two parallel lines determine a plane." To explain the action of a couple, the "moment of a force" must first be defined: "The moment of a force is the effectiveness of that force in producing rotation about an axis." It is measured by the product of the force and the perpendicular distance of its line of

action from the center of rotation. Thus, in Fig. 4 the moment of force F_1 about the axis of rotation O is

$$M_1 = F_1 d_1$$

Similarly, the moment of F_2 and F_3 about axis O is

$$M_2 = F_2 d_2$$
$$M_3 = F_3 d_3$$

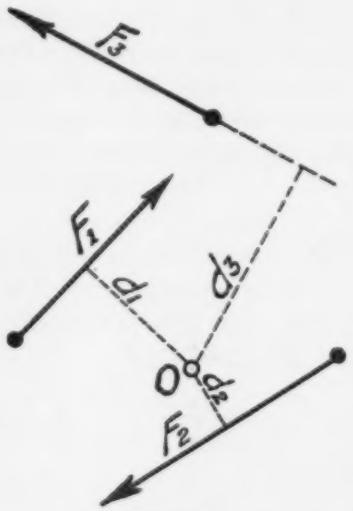

Fig. 4.

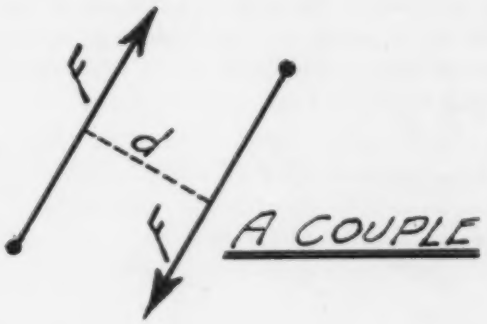

Fig. 5.

In the case of force F_3, the perpendicular d_3 is drawn to the extension of its line of action.

"The moment of a couple is the effectiveness of the couple in producing rotation about an axis." It is measured by the product of one of the forces and the distance between them. Thus, in Fig. 5, the moment of the couple is

$$M = Fd$$

It is to be noted that the moment of a couple is constant, and it has the same numerical value regardless of the position of the axis of rotation.

A tooth cannot be rotated without acting on it with a couple, which may be applied in several different ways. The simplest couple is illustrated in Fig. 6, where a tooth is tied to a plain labial appliance by means of a grass-line ligature forming a slipknot. Here, the couple is formed by the pull of the ligature and the pressure of the arch wire upon the tooth, where it comes in contact with it. Another couple is illustrated by Fig. 7 where it is formed by the pull of the steel wire ligature and the pressure of the arch wire in the bracket. Here it is to be noted that mechanically the couple depicted in Fig. 6 should be more effective, but on account of the slipping of the ligature it loses efficiency, and therefore the couple shown in Fig. 7 is more effective. The important thing to note is that, everything else being the same, the greater the moment arm of the couple the greater is its effectiveness. Therefore, the effectiveness of the couple in Fig. 7 can be increased by placing the bracket farther away from the rotating ligature. Here, then, we have a scientific explanation of appliance action for the rotation of teeth.

There are other factors which we must consider in connection with the rotation of teeth. In the different types of appliances, the action of the couple is different. In forming a couple with a labial appliance we may use a wire ligature, which pulls on one side of the tooth from a properly placed lug on a band. As it was shown before, the heavy (0.040) labial arch is not materially deformed by the pull of the ligature, and when the latter is applied the tooth is displaced from its position of rest an amount equal to its functional freedom plus the amount of give in the periodontal membrane and the alveolar bone. As soon as the tooth begins to move, the force is dissipated, and there is no further tooth movement. This is an example of an intermittent force of great intensity acting for a short period, which must be repeated very many times to bring about the rotation of a tooth. A very similar condition is created by applying a rotating ligature from a labial staple on a band to a 0.022 by 0.028 edgewise arch. If the recommended ligature pliers are used, a force of great intensity will be applied which would act for a short period. It may, however, cause more or less injury to the tissues because the edgewise wire is somewhat deformed under the action of the very tight ligature, and thus maintain the pressure for a more prolonged period than in the case of the labial appliance.

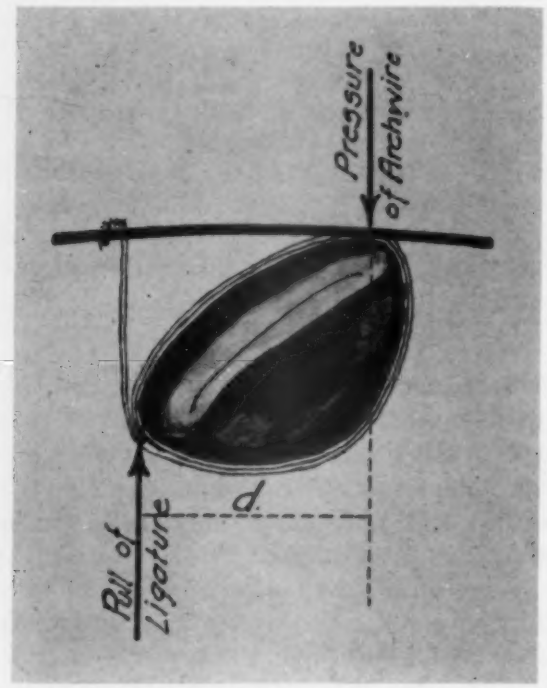

Fig. 6.

When a rotating ligature is applied from a lingual staple in the modified edgewise appliance, the light (0.016) wire will be elastically deformed and form a short-distance spring. In this instance the pull of the ligature is determined by the arch wire and it cannot be increased even by the use of the ligature pliers. If we attempt to tighten the ligature, the arch wire will receive a permanent set,

and the action of the ligature would always be governed by the residual spring action of the arch wire. This is an example of a small intermittent force, which is the most desirable for orthodontic purposes. There is a great difference between these two methods of force control. As it was pointed out, in the labial and edgewise appliances a great force is applied, while in the case of the modified edgewise mechanism the applied force is always limited in intensity. Furthermore, the light wire acts through a greater distance and produces a more definite tooth movement. On account of the spring action, average rotations can be corrected in very few applications of the ligature. It is my belief that with the modified edgewise arch all tooth movements take place during the first twenty-four or forty-eight hours after each adjustment. And, since adjustments are spaced four weeks apart, each tooth movement is followed by a long period of rest.

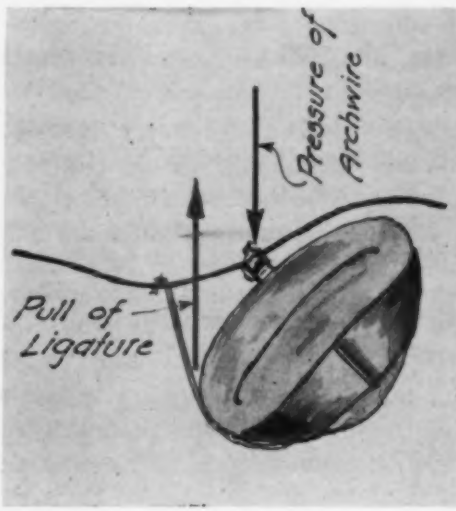

Fig. 7.

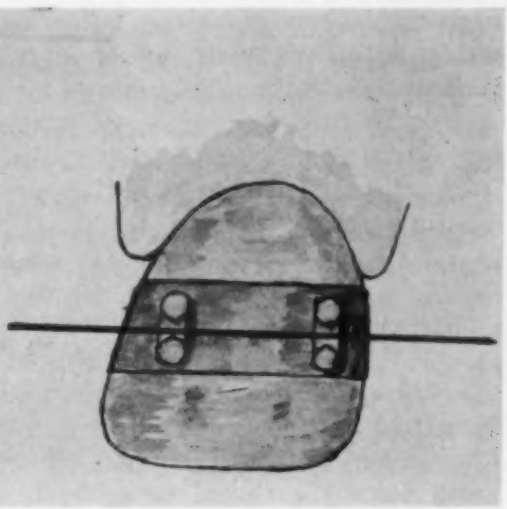

Fig. 8.

In a few instances, we cannot avoid the use of great forces. In such cases we must apply them for the shortest possible time, and after the required tooth movements are accomplished revert to the use of lesser forces. This may be necessary in the case of mesial or distal root movements which are efficiently performed by the use of double brackets (Fig. 8). These tooth movements are not very frequently required. Greater forces are required also for the expansion of the arches. With the modified edgewise appliance this is accomplished by using a 0.022 by 0.028 inch hard stainless steel wire for two or three adjustments after the teeth are aligned. They should never be used before the anterior teeth are brought into position.

In this discussion I have endeavored to show that a knowledge of elementary mechanics is very useful in solving orthodontic problems. But this is merely an introduction to the development of a subject which must necessarily form an important part of the scientific preparation for the practice of orthodontics. A full-year course on the "Application of Mechanics to Orthodontics"

should be a required subject of study in all postgraduate courses. This must also include a thorough preparation in the study of the "Mechanics of Materials," which I have not touched upon. Without a thorough knowledge of mechanics, it is not possible to understand the elastic arch and the behavior of arch wires in the various attachments. The engineering profession has already scientifically solved all problems in mechanics pertaining to orthodontics, and we cannot do better than to make use of all the available information. It will help us materially, and the application of well-established scientific facts can help us not only to understand better the action of our appliance, but, what is even more important, it will enable us to render better service to our patients.

Part II. The Passive Phase of Treatment

During the passive phase of treatment, changes are made in arch relationships and in the occlusal level. While these changes are slowly taking place, the teeth are also retained in the new positions in which they were placed during the active part of the treatment. Thus, it is made clear that all these changes are taking place simultaneously during the retention period.

An attempt should be made during the active phase of treatment to establish normal arch relationship by repositioning the mandible. This can be easily accomplished by the use of intermaxillary elastics. Whether this is the correct method of procedure we do not know at present, but after the elastics are discontinued one of two things may happen:

1. The newly created normal arch relationship may become permanent.
2. There may be a rapid relapse to the original malrelationship.

There can be no question about the fact that in many cases it is possible to correct disto- or mesioclusion by repositioning the mandible. The specialty of orthodontics was developed on the belief that this can be done, and we can all recall cases where corrections were accomplished by this method. But there were a considerable number of instances where the newly established arch relationship was not permanent. Relapse to the original condition was very rapid. The prolonged, persistent use of intermaxillary elastics brought about a mesial displacement of the entire mandibular arch through the bone, in relation to the body of the mandible. Dr. Charles H. Tweed pointed out to us that this resulted in bimaxillary protrusion in many of the corrected cases. This observation is correct and points to the possibility that in some instances the malrelationship of the arches should be corrected by repositioning the mandible, while in other instances by the distal movement of the entire maxillary dental arch. We have no acceptable method by which we can separate these two different types of cases. Therefore, every case must be treated first by repositioning the mandible. If the correction is not permanent, it should be followed by the distal displacement of the maxillary arch. We have not been able to do this in the past, and for this reason Dr. Tweed recommended the extraction of four premolars. It was explained that maxillary and bimaxillary protrusions could be very efficiently reduced and thus assure a better esthetic result. This teaching was eagerly accepted by an alarmingly large number of orthodontists, and an attempt was

made to declare it a standard procedure. The enthusiastic reports in our literature gave license to this practice, and extractions are recommended in about 75 to 80 per cent of all orthodontic cases. The injury caused by this practice can hardly be overestimated. First of all the dentitions of the patients are mutilated, and secondly if this enthusiasm is not checked the entire orthodontic specialty will fall into disrepute. We as a profession cannot accept the teaching that, protrusions cannot be reduced without resorting to the extraction of four perfectly sound teeth. This throws out a challenge to us, and we must be ready to meet it.

It is understandable that in the absence of an effective method it is held impossible to reduce maxillary and bimaxillary protrusions. As I have stated elsewhere, the acceptance of this closes the door on future research and gives license to extraction. The only permissible attitude we can take is that the reduction of protrusion has not been accomplished but that it is not impossible. About a year ago, I read a paper before the Pacific Coast Society of Orthodontists in which I described a new method for the reduction of maxillary protrusion. At that time the method was in use for about a year and I was able to show at least two cases in which the distal movement of all the maxillary teeth was an accomplished fact. I also reported that more than seventy-five cases were under treatment at my office for the mass distal movement of the teeth. Since then many more cases were treated by this method, and I am plased to report that while Class II relationships cannot always be reduced by moving the maxillary teeth distally, a beneficial change in facial lines is always brought about.

The acceptance of Tweed's teaching by such a large number of orthodontists presents a very alarming problem, the seriousness of which can hardly be overestimated. The repercussions of this practice will hang over our profession for many years to come, and it will be difficult to explain the permanent injuries inflicted on the patients in the name of science. Not so many years ago, the question of extraction was discussed by Angle and Case. The bitter controversy ended in the universal acceptance of Angle's teachings and the rejection of the practice of extracting teeth as a corrective measure, as recommended by Case.

When we look back on this early controversy, we will realize that there was little difference between Angle's and Case's attitudes. Case never recommended that for corrective purposes four teeth should be removed in 75 or 80 per cent of all orthodontic cases. The feud was waged over a comparatively small percentage of patients. Case believed that extractions may be necessary in about 7 or 8 per cent of cases. What I am discussing today is a more serious practice, and I am fully convinced that even Case himself would disapprove Tweed's teachings. Case was very selective, and he made his position clear in all his writings. In his book,* he stated:

> In a paper read before the National Dental Association of the United States, in 1911, the author showed from the statistics of his own practice that in all the cases which presented for treatment, there was only about one case in twelve to fifteen in which the question of extraction should ever arise. Inasmuch as there are so comparatively

*Case, Calvin S.: Technics and Principles of Dental Orthopedia, and Prosthetic Correction of Cleft Palate, Chicago, 1921, Case Company, chap. 12, p. 83.

> few cases which do demand extraction, and for which it is quite as much malpractice to avoid extraction as it would be to extract teeth when not demanded, it is doubly important for us to know exactly the character of those cases, and the kind of diagnosis by which they are determined.

According to this statement, one case in twelve or fifteen corresponds to 8.3 or 6.6 per cent. This differs materially from the figures established by Tweed, who claimed that extraction is indicated in 75 or 80 per cent of all cases. Thus, it is seen that Case, who championed extraction for the correction of malocclusion, would find it necessary to extract in only 7 or 8 per cent of cases. He gave the following rules for extraction:

1. Never extract teeth for the purpose of making the operation of correction easier, for whatever the malocclusion, the teeth can always—or with very few exceptions—be placed in arch alignment and in normal occlusion, and in a very large majority of all cases, they are needed in the arches, not only to perfect occlusion but to aid in beautifying the facial outlines. Therefore, so far as the relation of the teeth to each other are concerned, no dental malposition should be regarded as a basis for extraction.
2. Teeth should never be extracted in orthodontia, except in cases of excessive protrusions, producing decided facial deformities, or at least marked dento-facial imperfections and not even then, especially in young children, unless there is every indication of an inherent protrusion that will ultimately mar the beauty of the face for life. In nearly all locally caused malocclusions in immature arches, the final development of the jaws and general growth enlargement of the features demand all of the teeth and their sustaining alveolar arches to harmonize the facial relations. Therefore, in every case in which dento-facial protrusions can be corrected without extraction, we should strive to produce a normal occlusion, not only for the sake of its more perfect masticating character, but because of its normal developing influences upon associate bones.

On page 88 of *Dental Orthopedia*, Case further discussed the question as follows:

> Then the very grave question arises: Does the facial imperfection warrant the extraction of four sound teeth from youthful dentures which are now in perfect normal occlusion? If the protrusion is not very pronounced and cannot be traced to one or the other parent as a family type and the patient is under 12 years of age, one should never think of extraction until he has seen what the developing forces of nature will accomplish. If at 14 or 15 years of age it has partially disappeared, there is very good reason to believe it will wholly disappear at 18.

This statement of Case confirms my belief that in adolescents a certain degree of facial protrusion is the normal characteristic which disappears at a more mature age. Tweed overlooked this entirely and judged adolescents by adult standards.

A clear statement of the orthodontic problem as we understand it today is that the correction of malocclusion is always accompanied by more or less

facial protrusion, which in time is automatically corrected in a large percentage of cases. In a smaller percentage, such self-correction may not take place and we must resort to other means to correct the protrusion created by treatment.

Tweed and his followers confused those cases which correct themselves with permanent protrusions, and placed the untreatable cases as high as 80 per cent. If we can accept Case's report, then the untreatable cases will not exceed more than 7 or 8 per cent. With the promise held out by newer methods of treatment, even these can be materially reduced.

Several articles were written in the past few years which sought to establish diagnostic methods for the recognition of cases requiring extraction. It is needless to say that neither the roentgenographic, photographic, nor the cephalometric method is acceptable. Standardized radiographs in themselves do not shed sufficient light on the problem of growth, for the proper correlation of radiographs taken at different intervals has not yet been solved. The axial inclination of the mandibular central incisors as determined from standardized radiographs cannot be used to determine whether extraction in a given case is necessary. Before such decisions can be made, it becomes important to evaluate the accuracy of the method. Even if the x-ray tube is permanently fixed on a firm stand, the immobilization of the head is a difficult problem. It is necessary for us to know the variation in the size of the incisor-mandibular plane angle as determined from a reasonably large number of radiographs taken on the same subject at different sittings. Furthermore, it is equally important to determine whether there is a difference in the size of the incisor-mandibular plane angle, when measured on the right and left lateral plates. It seems to me that there must be a considerable difference because symmetry in nature is the exception rather than the rule. If we find that there is no difference between the right and the left incisor-mandibular plane angles and if the degree of accuracy of the method warrants it, then and only then may we look upon the axial inclination of the mandibular incisors as having diagnostic significance. Drawing lines on radiographs is a very simple procedure, but drawing them accurately is extremely difficult. Lines drawn on the same radiograph by the same individual at different times will show different results. In all such matters we must take into consideration personal equation, which will show itself in definite trends. Some individuals will always draw a line to the left of its true position, while others will always draw it to the right, and their determination of values will correspondingly differ. It is my firm belief that there is so much error due to this cause alone that the values obtained by such methods must always be questioned.

In the various attempts made to devise an acceptable diagnostic method, it became necessary to standardize the radiographic technique. It is also believed that for purposes of comparison the casts and photographs must be related in some manner to an arbitrarily fixed plane. There can be no quarrel with this belief, but it invariably leads to the design and employment of various types of instruments which are so inherently inaccurate that they cannot possibly have a practical value. They merely represent gadgets which if persistently

employed will dominate our way of thinking. We will set up standards consistent with these gadgets, and treat our cases accordingly. It is always forgotten that the standard adopted in any instance must in some way be verified. And again, standards may be the result of loose observations, so that they may be employed without the use of instruments.

Fig. 9.

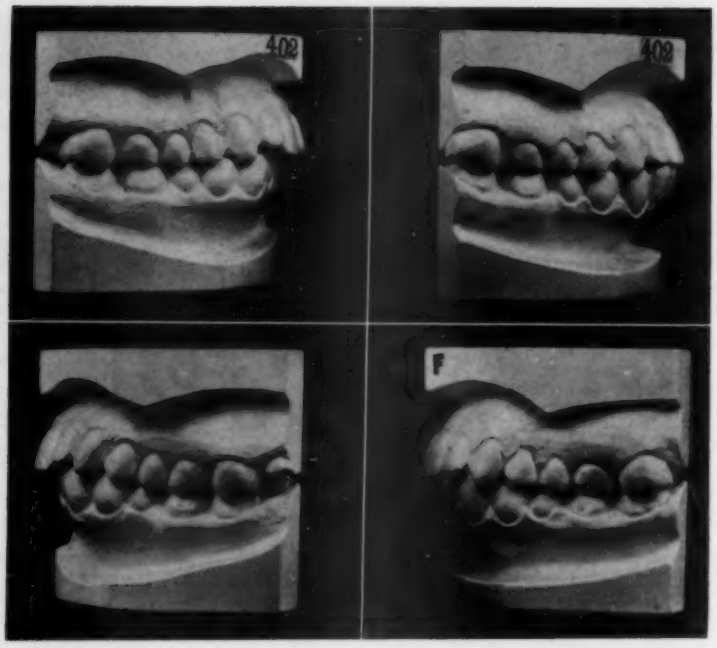

Fig. 10.

A classic example of this is Tweed's observation that for permanent orthodontic results the mandibular anterior teeth must be uprighted over the basal bone. This represents a false standard, which is responsible for the removal of more teeth than any other diagnostic concept. In this connection it is also stated that unless the mandibular anterior teeth are positioned as suggested the alveolar tissues will not be able to withstand the incisal stresses. Nothing can be farther from the truth. I present for your consideration a case which I completed some seven and one-half years ago, and which is out of retention for

at least five years. The patient came to me after approximately two years of unsuccessful orthodontic treatment. The extent of the relapse is shown in Figs. 9 and 10. Now, according to Tweed's explanation it is very clear that this case failed because the mandibular anterior teeth were off the basal bone at the end of treatment, and that there was a very marked bimaxillary protrusion. It may be pointed out at this time that it was not made clear what constitutes bimaxillary protrusion, but even without an acceptable standard I concede that these teeth are in protrusion. The case was retreated without extraction, with the result shown by models marked *F*. It is to be noted that while the teeth are much better aligned, the protrusion was increased. I am eager to show this case because it represents an extreme type of bimaxillary protrusion which, in view of the fact that it failed after the first correction, should have been

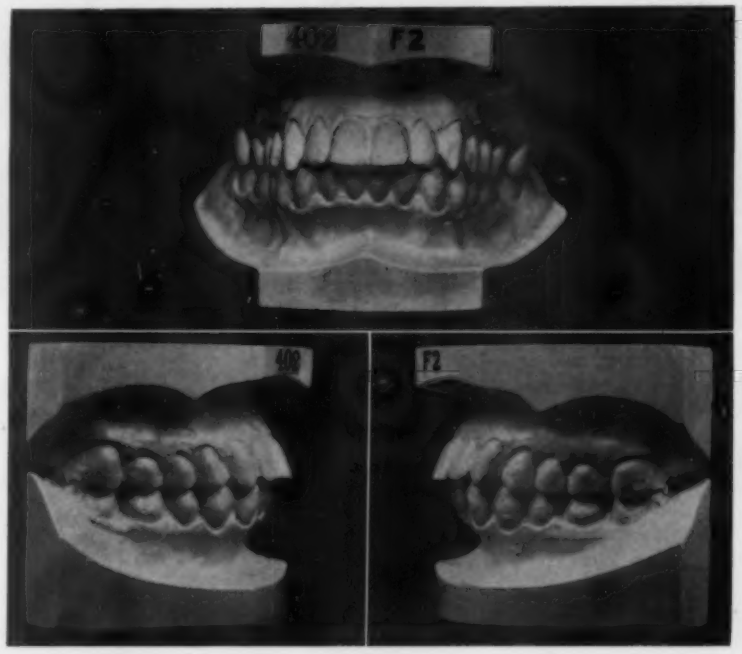

Fig. 11.

re-treated, according to Tweed, by the removal of some dental units. It so happened that at the stage depicted by models marked *F* the treatment was abruptly terminated, and while proper interdigitation was not established, retainers were inserted. This became necessary because the patient married and moved to San Francisco. During the retention period the case was supervised by an orthodontist of that city. A short time ago she returned to New York, and I took the impression for the models shown in Fig. 11 in December, 1947. The dentition settled into very good cuspal relation and the oral tissues at that time were in excellent condition. Fig. 12 shows the full-face and profile views of the patient at the time the models shown in Fig. 11 were made. Judging by Tweed's standards, facial disbalance is present, but the lower lip is not typical of the usual bimaxillary protrusion case, where the lips are more tightly drawn over the teeth. It is my belief that the flaccidity of the lower lip would be increased

by the removal of two mandibular premolars. Here we are dealing with a very large lower lip. But the importance of this case is the fact that it furnishes damaging evidence against the doctrine of the upright position of the mandibular anterior teeth over basal bone. If this case had not been re-treated, it could be cited to prove Tweed's contention. Re-treatment conclusively proves that the

Fig. 12.

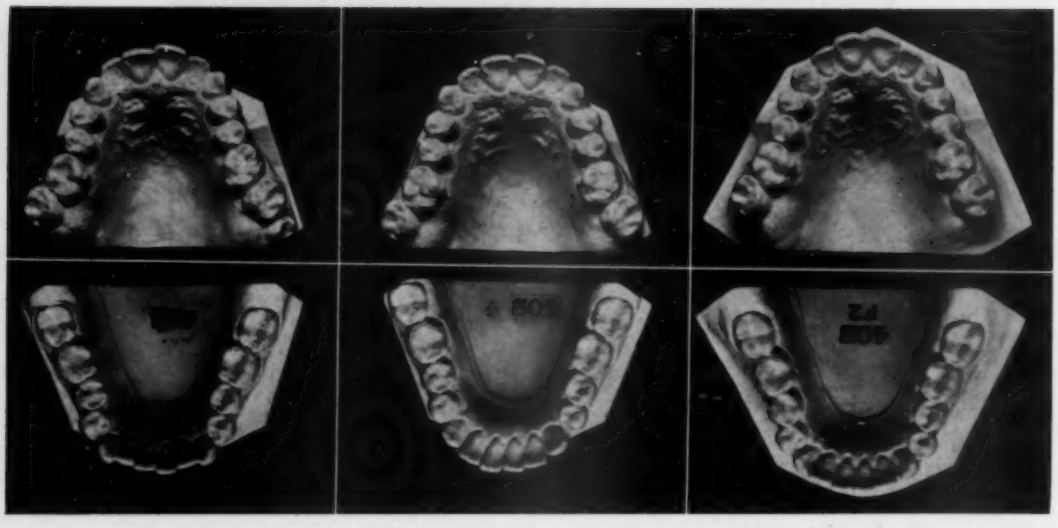

Fig. 13.

stability of a corrected dentition does not depend on the requirements annunciated by Tweed. This is an extreme case of protrusion, and if there is a particle of truth in Tweed's doctrine, this case should have failed after the re-treatment. There is, however, no sign of relapse (Fig. 13), which indicates that the stability of a corrected dentition depends upon many other factors, one of which must necessarily be normal occlusion.

The changes in arch relationship and in occlusal level are usually brought about after the active phase of treatment is completed. It must be remembered that an attempt is usually made to correct the distal relationship of the mandibular arch by means of intermaxillary elastics. This correction may or may not be permanent, and if during the retention period there is a tendency to

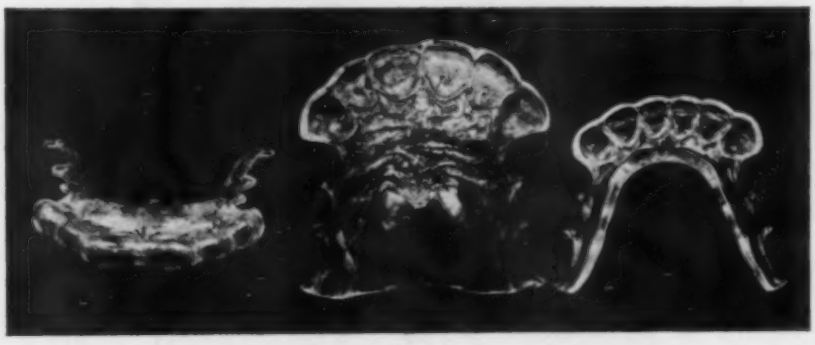

Fig. 14.

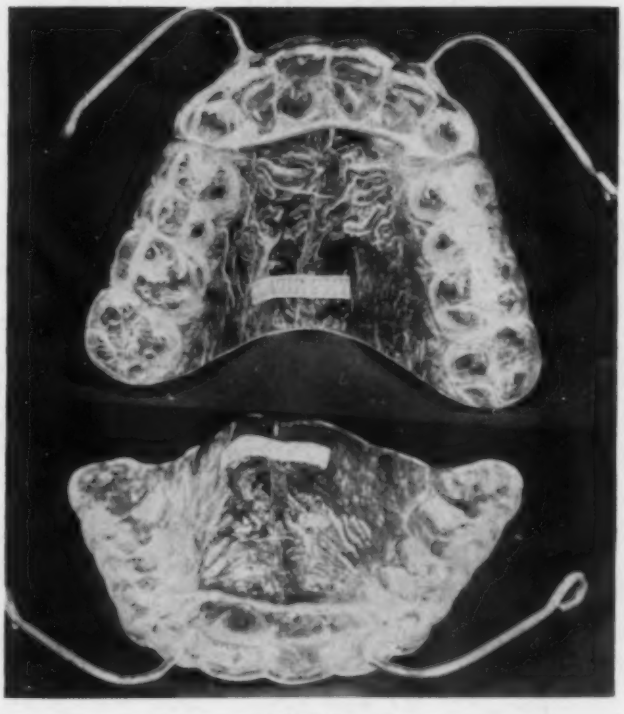

Fig. 15.

re-establish the distal relationship, it becomes necessary to correct this condition by the distal movement of the entire maxillary dental arch. If a deep overbite complicates the condition, upper and lower bite retainers are worn during the day (Fig. 14), and a maxillary splint with headgear is worn during the night (Figs. 15 and 16). The bite plates efficiently retain the teeth and also open the bite, which is necessary to avoid trauma. The effectiveness of the maxillary

Fig. 16.

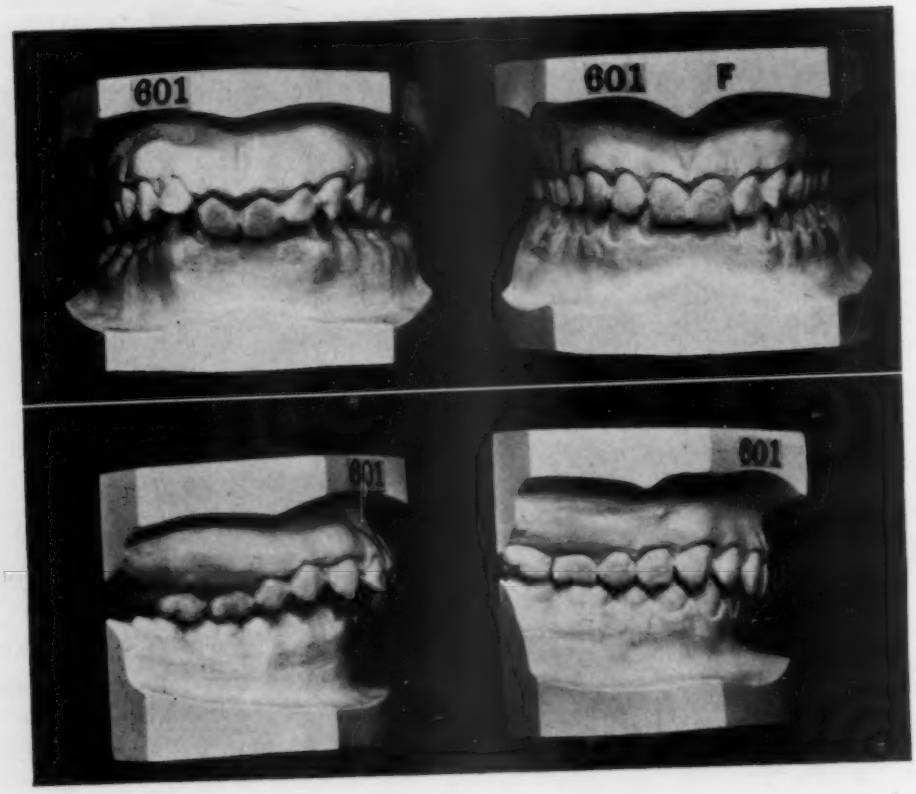

Fig. 17.

splint depends upon a well-adjusted headgear and the cooperation of the patient. If the headgear is not properly adjusted, it will be pulled out of position by the elastics, and will not bring about the desired result. Frequently, the distal movement of the entire maxillary arch cannot be accomplished because the patient refuses to wear the appliance. My experience is that with the cooperation of the patient the response is usually favorable.

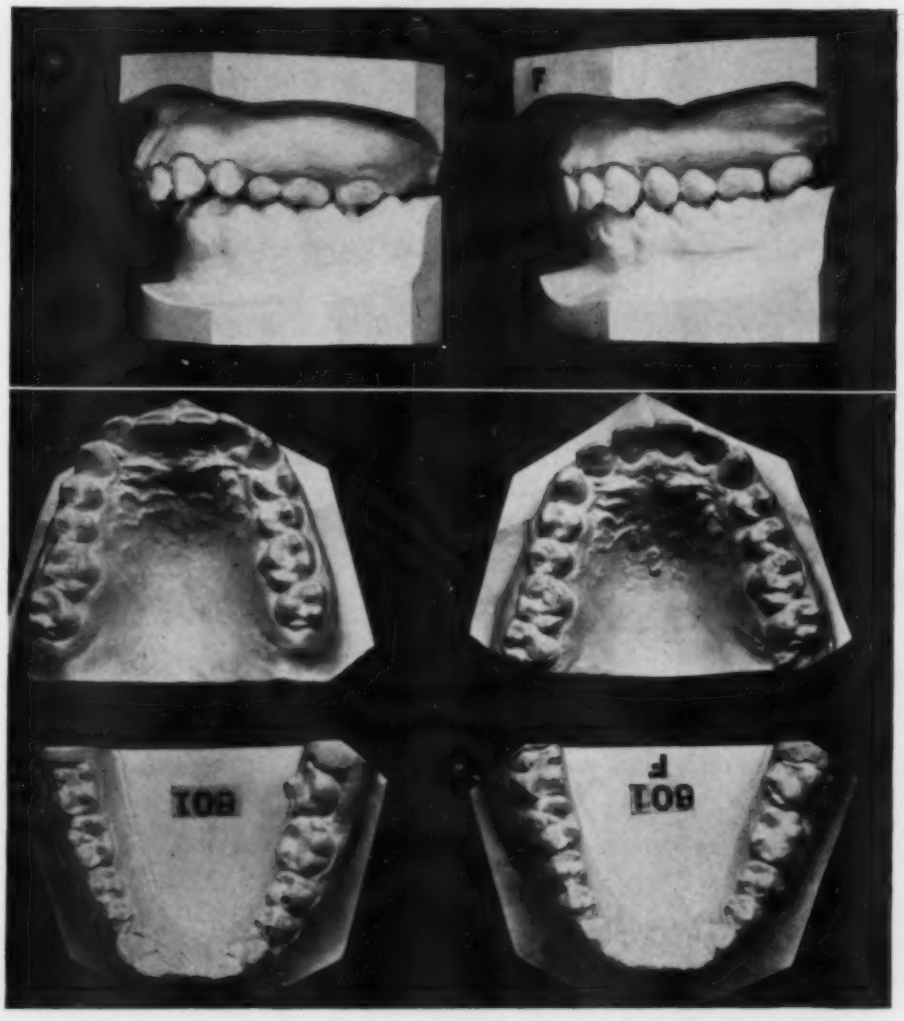

Fig. 18.

The possible extent of correction is shown by the following three cases. The correction of the distal relationship by the use of intermaxillary elastics failed in all these cases. Subsequently, normal arch relationships were established by means of the maxillary splint and headgear, which effectively reduced the maxillary protrusion by the distal displacement of the maxilla.

Case 1.—This case was the first one treated by this method, and was reported about a year ago at the meeting of the Pacific Coast Society of Ortho-

dontists. Figs. 17, 18, and 19 show the various views before and after treatment, and also the photographs of the patient. Note the change in the axial inclination of the posterior teeth, especially the premolars and the canine.

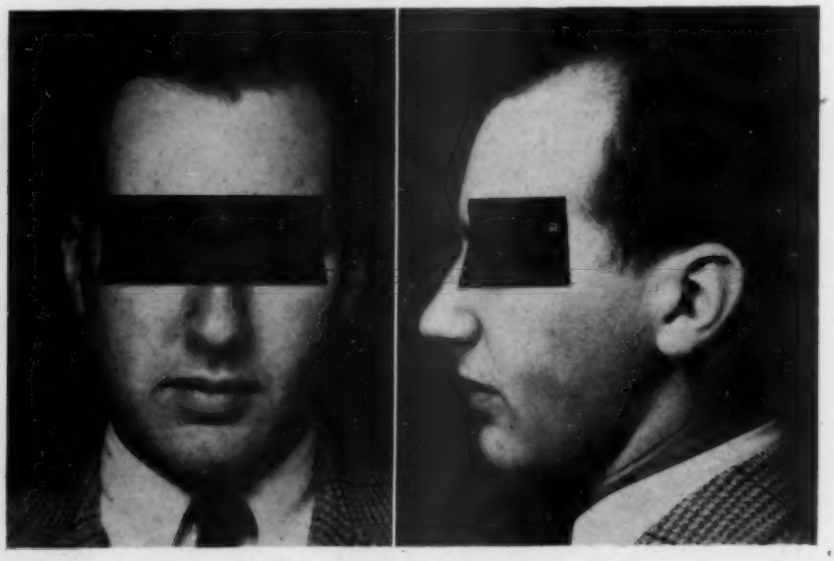

Fig. 19.

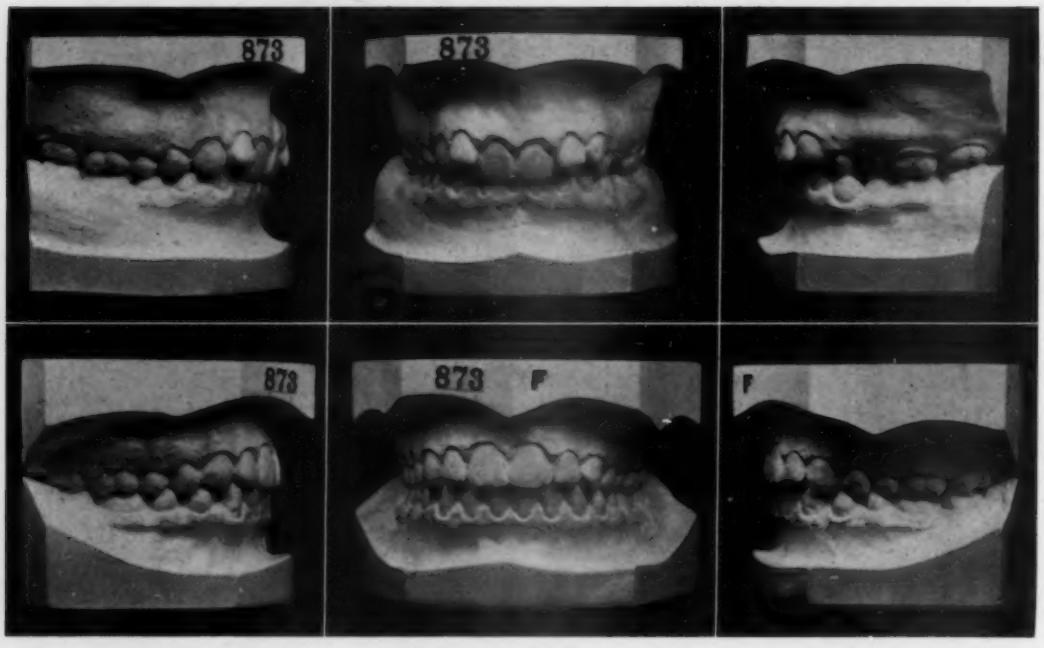

Fig. 20.

Case 2.—This is a similar type of case in which similar results were obtained. The maxillary splint was worn for nine months and is still being worn at night. Fig. 20 shows the front view and the right and left lateral views

of the models made before and after treatment. Fig. 21 shows the occlusal view of the models before and after treatment. The change in arch relationship was brought about by the distal movement of all maxillary teeth.

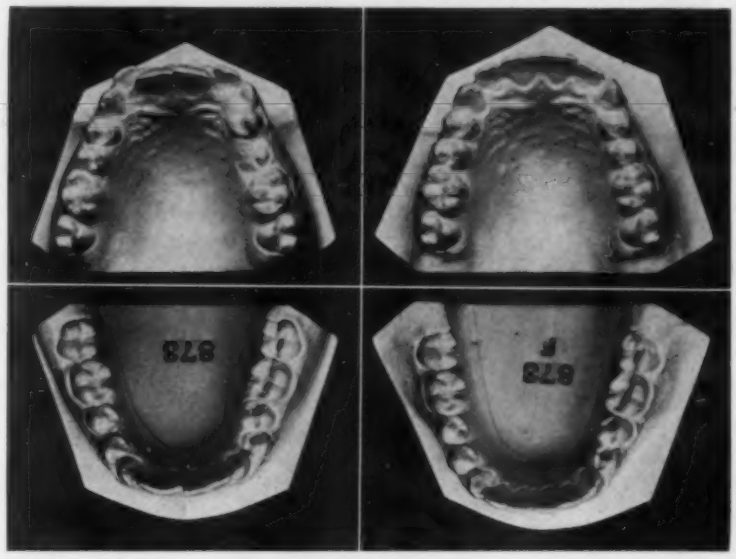

Fig. 21.

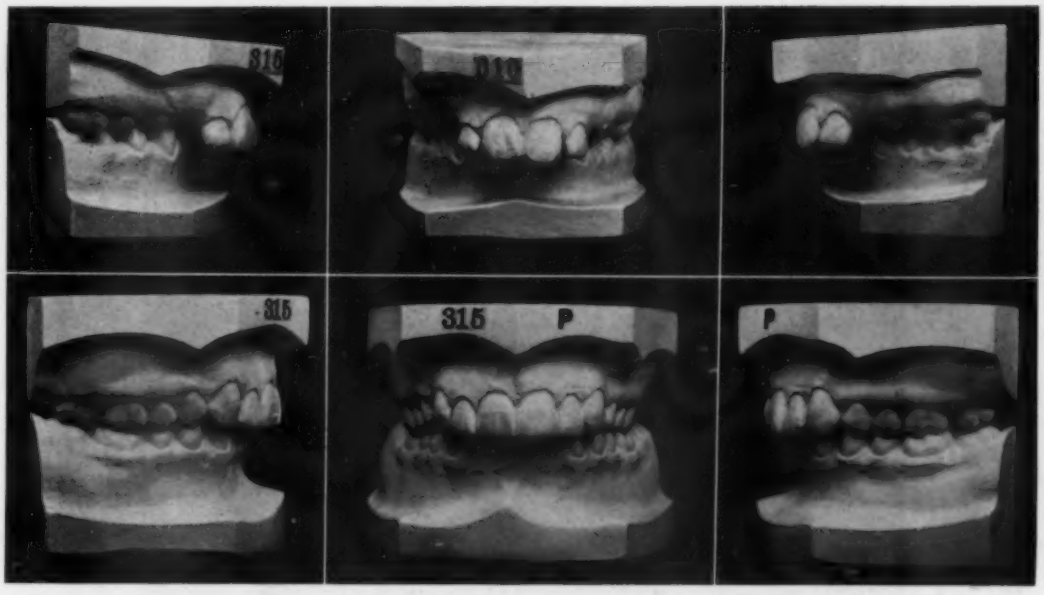

Fig. 22.

CASE 3.—Case 3 is a Class II, Division 1 case which was treated by the modified edgewise arch appliance from Sept. 15, 1941, to May 23, 1943. During the active treatment of twenty months, intermaxillary elastics were used quite freely. The change in occlusal relations was not permanent, and it became necessary to re-treat this case by means of the distal splint which was inserted

in April, 1946. Figs. 22 and 23 show the various views of the case at the beginning of treatment and on Feb. 15, 1947. The progress model shows a definite improvement in the distal relationship.

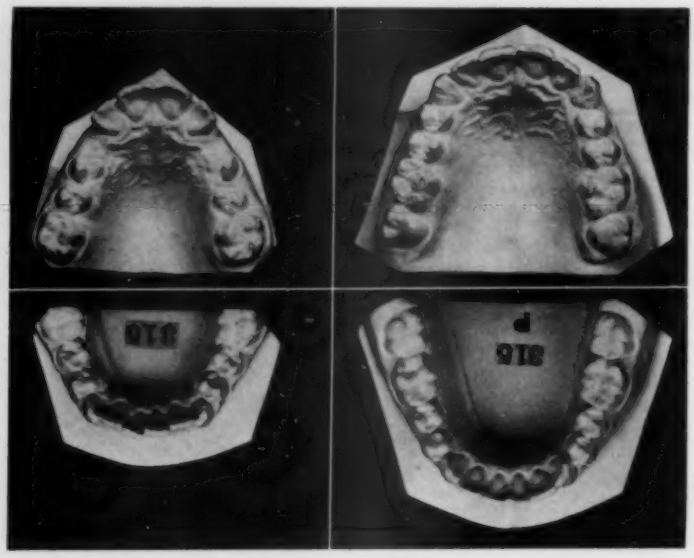

Fig. 23.

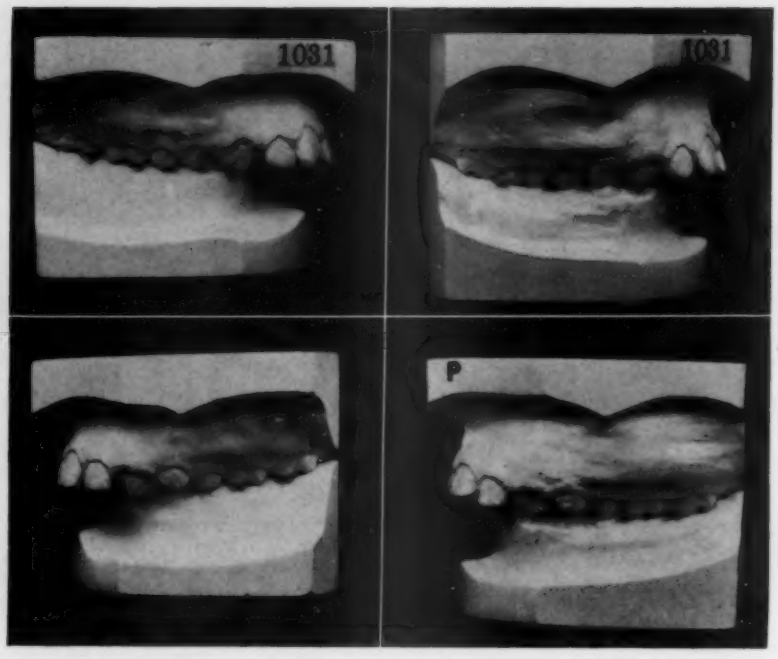

Fig. 24.

In the three cases just presented, the change in arch relationship was accomplished during the retention period. Indications are that it may even be a better practice to prepare a case for active treatment by first reducing the

maxillary protrusion. This appears to be quite successful in Class II, Division 1 cases. During this pretreatment period, the patient is required to wear upper and lower bite plates throughout the day, and a maxillary splint with head-

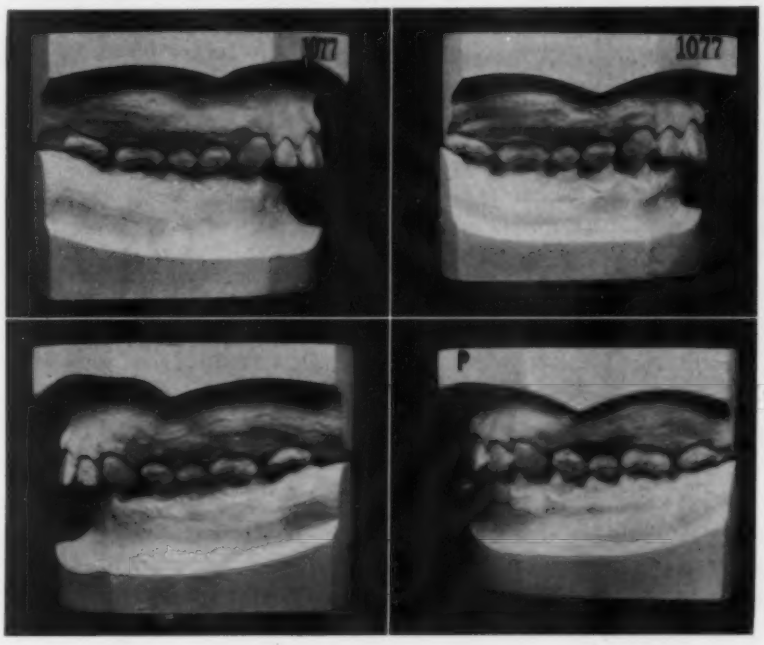

Fig. 25.

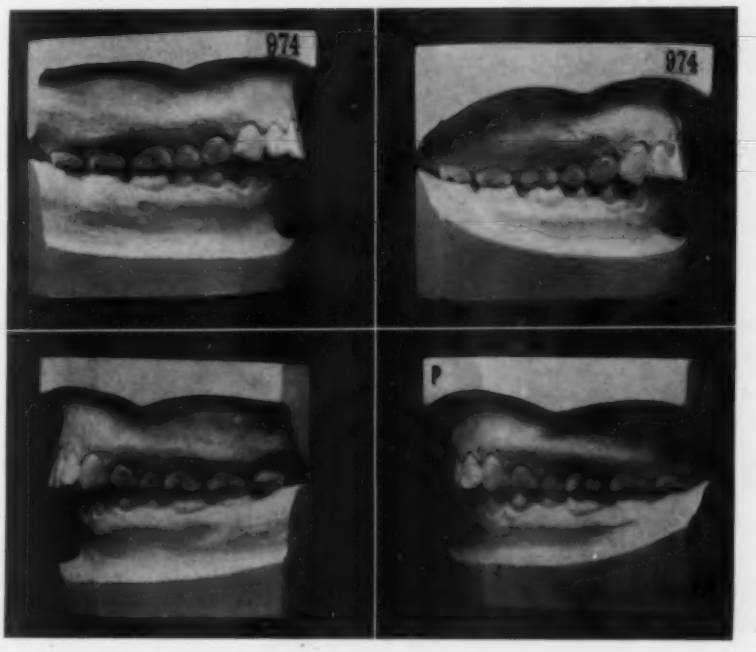

Fig. 26.

gear at night. Thus, the bite is opened and the distal relationship corrected before active treatment is begun. The results of such preparations are shown in Figs. 24, 25, and 26.

In Fig. 24, the change in arch relationship was accomplished in ten months by the maxillary splint. Upper and lower bite plates were worn during the day. The case shown in Fig. 25 was similarly treated and the change was brought about in seven months. Fig. 26 shows a case which came to me after two years of unsuccessful orthodontic treatment. The distal relationship was corrected in twenty months, but it was not necessary to open the bite. Therefore, bite plates during the day were not used.

The results obtained in these three cases definitely prove that it is possible to reduce maxillary protrusions by means of the maxillary splint and headgear. This, however, was questioned on the ground that the change in arch relationship may be due to the repositioning of the mandible induced by the bite plates. In answer I submit that without the use of the splint I have not been able to reduce the distal relationship and, furthermore, in the last case shown, bite plates were not worn during the day because the bite was sufficiently open at the beginning of treatment. A temporary change in the position of the mandible may take place as a result of the "bite of convenience" at some point in treatment when it is more comfortable for the patient to bite forward. However, the persistent use of the maxillary splint will drive the maxillary teeth farther back, and soon a point will be reached where it will not be necessary for the patient to bite forward. Thus, a dual bite of the mandible will be eliminated. The occurrence of a dual bite does not prove that a distal movement of the entire maxillary arch is not possible. The temporary change in the functional position of the mandible indicates that some changes in the maxillary arch must have taken place or the patient would not find it more convenient to bite forward.

I do not wish to convey the thought that the changes just discussed can be very easily brought about in every case. On the contrary, so long as we practice orthodontics we shall meet with a reasonable percentage of failures. But that is true of every department of medicine and dentistry, and the fact still remains that only those who do not practice orthodontics will have no orthodontic failures. As we all know, many factors enter into the successful termination of a case, and very frequently we cannot depend on the cooperation of the patient.

The importance of this approach to the treatment of malocclusion is that extraction is not accepted as a standard or harmless procedure. The reduction of maxillary protrusion, which is held to be impossible by the extractionists, has been accomplished in a sufficiently large number of cases to impress upon us that the final word has not been said on this subject. The method I am using opens up a new field, and further study may result in the development of more positive procedure, so that in the future we may undertake the treatment of maxillary protrusion with the knowledge that it can be definitely reduced. In the meantime, I shall keep on treating my cases without extraction, for I am fully convinced that I shall render better service by preserving the full complement of teeth.

654 Madison Avenue.

ORTHODONTICS AND THE DISORDERS OF SPEECH

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THE ability to express emotions, meanings, thoughts in infinite detail, variety, and complexity is commonly accepted as the one great function that sets man apart from animals. This communicating trick of uttering a series of grunts and squawks, hisses and snarls built up in a sterotyped signalling system has made possible our modern civilization, our modern human culture, and the educative processes upon which civilization and culture stand.

Talking is not an inherited function. Every normal human child comes into the world with a central nervous system more complex than any animal, and with a respiratory and eating mechanism that is capable of learning the artificial modes of communication found in any language. Speech is learned in infancy from parents and other children before memory is adequately developed, and thus is as much a subconscious part of us as our hands, our feet, our eyes, and our tongues.

Fortunately, most children do learn to talk normally. They come into the world with undamaged nervous systems, with normal hearing acuity, with seeing eyes, with intact palates, with functional larynges, and with jaws that bite properly. But about one in twenty children suffers harm to some part of this mechanism and without treatment becomes a social misfit, suffers difficulties in learning, and in severe cases is forced to accept permanent care from society.

While speech is primarily a function of the central nervous system, abnormalities in the peripheral speech organs, of course, militate against the development of normal language. These disorders are the common meeting ground of the orthodontist and the speech correctionist.

There are certain disorders which frequently necessitate orthodontic maneuvers prior to adequate speech correction work. These are certain types of malocclusions and irregularly erupted teeth, cleft palates, and tension athetosis in cerebral palsy.

MALOCCLUSIONS

In the various types of cross-bite, overbite, underbite, medial-open-bite, etc., the difficulty in speech is generally found in those articulatory movements which produce hissing, or so-called friction noises. The normal production of these sounds is characterized by a pocket reservoir of air above and behind the radix of the tongue, a varied series of narrow openings between the blade and apex of the tongue and the hard structures of the palate and upper teeth, and forceful expulsion of the air and sound against the lower front teeth as far

Presented at the meeting of the Southwestern Society of Orthodontics, Wichita, Kan., Feb. 2, 1948.

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back as the second premolars in certain consonants. On the other hand, the so-called plosive consonants (*t,d,* etc.) are only rarely affected in malocclusions.

A brief discussion of these fricative consonants may clarify the following discussion:

1. Th (The; Throw).—This consonant is produced with or without laryngeal phonation. The hissing noise is produced by a flat stream of air between the apex of the tongue and the cutting edges of the incisors (if present).

2. F, V (For; Vine).—*V* mainly adds laryngeal sound to *f*. Here there is another flat stream of air between the lower lip and the upper incisors. Obviously, malocclusions may prevent this contact.

3. S, Z (Say; Zebra).—*Z* again mainly adds laryngeal sound to *s*. The apex of the tongue (or blade) is depressed in the midline, and lifted to the alveolar ridge. A small tube of air is thus formed running forward across the ridge and directing a sharp blast of air against the cutting edges of the upper and lower incisors. The hiss is produced by the narrow stream of air, but high frequency friction noises are normally added by the passage of air across the sharp edges of the incisors.

The malocclusions cause difficulty in several ways. For example, the movement of the mandible forward or backward from its normal position may make it difficult to hit the lower teeth with the air blast. A more prevalent defect develops in consequence of the inability of the tongue to make a normal contact against the alveolus. Thus, failure of these consonants may occur, or the frequency may be so low as to be defective. In medial open-bites, the tongue is generally found to protrude through the opening, due to lack of proper landmarks and adequate restraint of the dental circles, with a consequent failure of a hissing noise, or frequently a production of a *th* noise instead of the high frequency *s* or *z*. In cross-bites, or in lateral open-bites and sometimes in medial open-bite, what is known as the single or double lateral *s* may develop. This sound, which is not found in English, is normal in Welsh. Here an occlusion is made by the apex or blade of the tongue at the alveolar ridge, and the air stream is directed to the premolars and first molar on one or both sides. This results in a blurred, saliva-throwing noise, very disturbing when found in English. In Welsh, the consonant is actually the mate of the English *l* produced without laryngeal phonation (*ss* or *ll*).

4. Sh, Zh (Show; Pleasure).—These two consonants are produced similarly to *s* and *z*, but with a wider tube across the alveolus, and with a contact some farther back toward the vault. The same difficulties occur relative to the malocclusions.

5. CH, J (Chat; Jaw).—These two sounds are combinations, more or less diphthongal consonants. The tongue is placed against the alveolar ridge as though a *t* or *d* were to be made, pressure is built up against this occlusion, and the tongue drops suddenly into the positions for *sh*, or *j*, producing an explosion of friction sounds. The same remarks as for the latter consonants are in order.

6. L (Log).—The apex of the tongue is placed against the alveolar ridge. The sides of the tongue lie close to the upper molars on each side, the loosest

contact being at the premolars. Friction noises of low frequency are added to the laryngeal sound as it passes between the tongue and the molars on each side and exits from the angles of the lips. The malocclusions produce their effect mainly by making it difficult for the tongue to assume the desired position.

7. R (Row).—R is made in at least nine different ways in the general American dialect, which we all speak here. Essentially what is needed is a constriction between the upper surface of the tongue and some portion of the hard or soft palates so that an irregular ellipsoid is formed with a very narorw vertical diameter. The ellipsoid obviously has its horizontal axis curved to conform to the vault of the palate and the surface of the tongue. Sound from the larynx coming through this narrowed space has friction noises added to it, as can be illustrated by blowing through the *r* "position" without laryngeal phonation. This sound, which is the most frequently defective in English, is interfered with by the malocclusions mainly by reason of accessory changes in the tongue due to changes in the bite.

This description, it should be noted, explains these sounds from a physical point of view. The positions of the tongue, etc., as described, picture the normal or average way of accomplishing the kind of noise desired. Obviously, these stereotyped signals developed through the ages on the basis of a certain average structure and function and the positions assumed by normals to produce these noises are the result of chance pure and simple. It so happens that given an average occlusion, an average tongue, and an average palatal vault, the sounds will be produced in an average way. This does not mean it is the only way that the sounds can be produced.

This can be illustrated by a typical case: M. R. was seen at 9 years of age. At five he had recovered from a severe bulbar poliomyelitis. This had left him with a complete flaccid paralysis of the mouth. The lips remained everted completely, showing both upper and lower teeth. Two attempts had been made to insert fascia into the lips in order to bring them to a position not so noticeable. The fascia would not remain anchored, and further surgery was foregone. His speech was interesting in that all of it was normal with the exception of the labial sounds. *W, wh, m, p, b, f,* and *v* were all missing with consequent lack of intelligibility. This boy was failing in school, and was a truant problem. Interestingly enough, he was ashamed and humiliated, not so much because he could not close his mouth, but because his speech was so lacking and because he was shut out from normal human contacts with other children. Proceeding on the principle that these sounds can be made in many ways beside the average normal way, and all that is necessary is to get the physical frequency spectra correct, he was taught to compensate for the loss of lip movement by the use of the tongue. The tip of the tongue was made to substitute for the lower lip. He became extremely facile at this, so much so that the movements of the tongue could barely be seen, and his speech became normal. When last interviewed, he was happy, and as well adjusted to life as others of his race can be. At least he was earning his own living and not at all conscious of any difference existing between himself and others.

The point is that the malocclusions prevent normal movements from developing by the usual chance system. They do not mean that normal speech is not possible as long as the malocclusion exists. Speech correction is able to produce normal speech in these cases by teaching compensatory movements, even in spite of the malocclusion. However, this is usually the result of considerable expenditure of effort, time, and money, and good esthetic results are not usually possible.

Close cooperation between the speech correctionist and the orthodontist is highly desirable. Movements of the tongue and mandible have a very definite effect upon the dental circles. During orthodontic intervention, a child can be taught habits of movement of the tongue and jaws which will assist in the maneuver. The correction of malocclusions while the tongue is manipulated improperly adds a further burden to a very difficult task.

Therefore, as soon as a child appears at the Institute with an anomaly of occlusion, he is referred for diagnosis and possible treatment. This permits the planning of a course of correction both structurally and functionally that will lead to the best possible result.

On a practical basis, there are some financial difficulties relative to the problem of providing orthodontic care for these cases. In Kansas, the Capper Foundation is about the only organized source of funds. When the Institute has a case needing attention, it has been necessary always to find private philanthropy in order to get the work done. In many instances the orthodontist has contributed all his services without charge. Since these handicaps are at least as important to a child as any other crippling condition, it would seem desirable that some source of organized funds be made available for this purpose.

The Institute saw a young man, 20 years of age. He had a rather severe loss of hearing, and a medial open-bite with contact only at the third molars. The double handicap had resulted in complete loss of intelligibility and inability to find work. He came from a poor family unable to support any cost of any kind. The Institute has funds to provide corrective care for such cases, but not sufficiently to give hearing aids, orthodontic or medical care. An orthodontist was called, and he agreed to see the case and after examination agreed to provide his services if the laboratory work could be paid for. The Institute found an oil man willing to advance $200 for this purpose. Another wealthy friend agreed to give money for a hearing aid. The young man was not particularly willing to accept charity, but finally after some argument did so. Inside of two years he was talking normally, and is at work at the present time. The gain to society financially is obvious. It is difficult to measure the amount of humanitarian accomplishment.

To summarize, in the malocclusions normal speech is the expected outcome in cases of average intelligence and with normal or corrected hearing, provided expert care can be given in speech correction and orthodontics.

HIGH-ARCHED AND FLAT-ARCHED PALATES

Conditions which gave more concern years ago than they do now, so far as speech is concerned, are the so-called high-arched and flat-arched palates. Although these conditions interfere with the normal development of articulation in

a very similar manner to the malocclusions, speech corrective techniques have progressed to the point where the structural difficulties are readily and easily surmounted. Compensatory movements of the tongue have been well outlined, and are rather quickly made to occur. Thus, reference for orthodontics is more often for esthetic than for clinical reasons. Nevertheless, these conditions do produce speech disorders, and if they could be prevented or treated early, a great amount of tragedy could be avoided. Also, the severer cases need orthodontics for other reasons than speech.

These cases seem, from the Institute's studies, to be more frequent in homes where there has been malnutrition, inadequate medical care, etc. Mouth breathing, thumb-sucking, adenoids, and similar conditions might possibly be more prevalent.

The Institute had three children from the same family: A girl aged 9, a boy aged 8, and a brother aged 6. All were completely unintelligible, failing in school, and were referred by the school physician who said he was sorry to make the reference because nothing could be done for this family, or these children. These were the most miserable specimens you could imagine. They were dirty, ill-kept, timid, and shut-in, as many speech defective children are, due to the leverages of ostracism on the personality. They had impetigo and ringworm that was being treated by the father with tobacco juice. This is mentioned to show the social background, and probably give insight as to the health conditions of these children previous to the visit. All had high narrow vaults, the girl having the most severe. All were reported to have sucked their thumbs until 5 years, and all had adenoids. These children were, without question, heading for care by society. It took about a year to finish work with them. They are at present in school, passing all subjects. The Institute does not want to claim credit for everything, but with the correction of these children, the family began to take pride again. The children were given clothing and instruction in cleanliness. The Institute believes that the children it sees must have an equal chance for success, and justifies its existence on the outcome of the patients not only so far as speech is concerned, but clear through to the best possible vocational and educational solution. It may be mentioned in passing that the Institute supervises for the Junior League of Wichita an occupational therapy workshop where the bridge is built between the correction of these defects and eventual self-employment. Thus, in these cases, not only the children recovered, but the family, apparently as a result of the interest shown, made considerable strides toward self-support, and at last reports, the father was off relief and earning a living. Relative to the high palates, they are still high, but it is interesting to note that there has been a considerable widening of the dental circles due to normal tongue pressures.

CLEFT PALATES

The incidence of cleft palate in this country varies from about 1 in 800 to 1 in 2,200 births, the latter being the Kansas estimate. Surgical treatment has been the method of choice in this country for at least twenty-five years, but interest has been renewed in prosthetic applicances by the work of Harkins and,

independently, Fitz-Gibbon in the East. In Kansas, under the Crippled Children's Act, all children born with cleft palates can have surgery. Since all of the speech-corrective work with these cases is done at the Institute, a rather wide experience in the correction of cleft palate speech has been developed, and the improvement of these techniques has led us to the point where the prognosis is extremely favorable for normal speech.

After successful surgery, a child with normal intelligence and normal hearing can expect to talk normally. Successful surgical intervention needs some definition. From the point of view of the logopedist, a successful operation leaves an extremely long palate, which need not be mobile at all, but which permits free constricture of the salpingo- and superior pharyngeal musculatures. The reconstructed palate should attain a distance of about one-quarter inch from the posterior pharynx, or may be attached to it. Surgical intervention cannot always produce this due to difficulties with scar tissue, tissue transplants, and the general status of the mouth prior to operation. Speech corrective work is ideally commenced within thirty days after operation so that bad habits are prevented.

The major difficulty in these cases is, of course, the unpleasant, unintelligible speech. The mechanics of the speech disorder may be described as follows: In all of the speech sounds of English, of which there are some 660, with the exception of the nasal families of *m*,*n*, and *ng* (there are difficulties here in inoperated palates also), the requirement of each for essential sharpness and intelligibility is a pressure development in the mouth. This is accomplished by elevation of the palate, constricture of the salpingopharyngeus and other muscle laterally, and the forward movement of the upper part of the superior constrictor pharyngeus. The result is essentially a sphincter or squeeze valve, closing the mouth from the nose. For example, to say the consonant *p* the lips are closed, the oronasal valve is closed, and air pressure is built up behind the lips. The lips are opened suddenly; an explosion of air occurs, and this disturbance travels to the ear of the listener who has learned in childhood that this sort of noise meant that someone had gone through the motions described. The cleft palate child has in fact no oronasal valve, and cannot build up the oral pressure. The result is a nasal slurring, which is quite impossible to understand.

The prosthetic appliance attempts to substitute for the operation some sort of hard substance anchored to a plate or the molar teeth which can be grasped by the sphincteric valve.

Early attempts to build obturators failed for much the same reason as early surgical attempts. What is needed in the mouth is not an approximation of anatomical normality, but a sufficiently practical device so that a closure can be made. Thus, surgeons attempted early to produce a velum with an upward and downward movement, not realizing that this was not absolutely essential. Thus, many short velums were created which could not occlude the oronasal port, and were thus useless. In prosthetic appliances, most were made with a hinged flap at the back which was supposed to, and did after a fashion, flutter up and down as air was pushed toward the nose. The disadvantages were dirt, discomfort, inefficiency, and wearing out of the apparatus. The attempts of Harkins

and Fitz-Gibbon provide a static plate extending into the pharyngeal cavity with a bulb on the end which can be grasped by the salpingo- and pharyngeal musculatures much as the live tissue moved into place by modern surgery. Excellent results have been obtained due to this fundamental insight into the function required.

The controversy is one which the speech correctionist views with interest. The techniques of correction are practically identical. It may be stated, however, that prosthetic appliances still have some objections. Even though made of modern plastics, they do tend to produce gagging in adults, they do get dirty, they do need expert care permanently, and in children they need frequent replacement. The operation, once completed, is done for a lifetime. The appliance, on the other hand, presents no risks, and can be used on patients who cannot be operated upon for one reason or another.

The operation or the appliance only gets the case ready for corrective work. New habits must be trained, new muscular skills developed, and normal speech is only the remotest of possibility without expert corrective care. Thus, the orthodontist should make reference as soon as possible after making arrangements for the fitting of an appliance.

The following case illustrates the reason this work is important. A 15-year-old girl was referred as speechless to the Institute by the county nurse. She had been operated upon two years previously for cleft palate. She came in filthy, with a dirty dress, her hair uncombed, and one stocking hanging down. Her head was bowed; she would not look up, and all she would say was "Uh-huh" or "Huh-uh." As so many of these patients do, she had retired within herself. Her mother was a scrub woman, and worried about what was going to happen to her daughter when she could no longer scrub floors. I asked the girl later why she did not talk, and she said that when she went to school and started to say something in the first grade, all of the children laughed at her, and she just decided she would never talk again. About two months later a call came from the county nurse. "What have you done to Genevieve?" she asked. "Why?" "Because I passed her on the street today, and she had on a clean dress, her head was up, and she actually spoke to me." I told the nurse that she simply was regaining some confidence and that the results would probably be good so far as her speech was concerned. Well, they were. She was dismissed about six months later with absolutely normal speech. It was impossible to detect the slightest variance from the normal.

About two years later, a call came again from the same nurse. She requested help. Upon inquiry, it seemed that the child was a terrible problem. The nurse said the teachers had given up, the principal had decided to ask her to leave school, her mother said she could not handle her, and the nurse herself had been to the house, and was unable to proceed. I asked what the trouble was. "Oh, she talks all the time, in halls, in classes, and anywhere she pleases. She is a terrible discipline problem." I said I thought she was overcompensating, and that if everyone would let her alone she would soon get over it. She did. She graduated from high school with good grades, and got a job where she met the public every day. And she retired her mother from scrubbing floors. She is

now married, with two normal children. This case has saved society money sufficient to pay for any number of unsuccessful ventures. But better than that are the intangible values of getting this child able to be human in a world where to be human is to be able to talk.

CEREBRAL PALSY (TENSION ATHETOSIS)

The most severe and difficult of the disorders in which the orthodontist and the logopedist work together is cerebral palsy. This condition in which there is selective injury to the motor tracts of the central nervous system is at least as frequent as poliomyelitis. Widespread national interest in it as a condition is only recent.

At the Institute of Logopedics, work has been carried on with these cases for the past fourteen years, and about 30 per cent of the case load has always been occupied with this severe and distressing problem.

Most of these children are intelligent. The difficulty is for them to express this intelligence when the severe cases cannot control their arms, legs, sit up, feed themselves, or talk. The fact that the brain is injured means to many persons that they must not be intelligent, but the brain is a complex and intricate structure which can be injured and leave mentality nearly intact, provided the damage is not too extensive.

The term cerebral palsy covers a number of motor coordination difficulties more or less loosely grouped together. Spastic paralysis is the type found in injuries to the pyramids, and consequent reduction of inhibition in reciprocal movements. Any attempt to move a joint either passively or actively too rapidly produces a contracture of the antagonists of the movement. Athetosis refers to an injury to the extrapyramidal tracts, and is generally expressed by constant writhing movements due to synchronous discharges of energy in an irregular fashion to the agonists and antagonists. It is frequently masked by what is known as tension athetosis, in which bizarre patterns of movement and position are taken by the patient and held rigidly. When these are relaxed, the athetosis becomes overt. Cerebellar ataxia is shown by lack of synergy, overshooting, loss of balance, etc. Rigidity occurs in severe cortical lesions, and is characterized by lead-pipe joint movements and lack of normal elasticity in muscles. Tremors of various types occur.

Because of the complexity of the subject, the remarks here will be illustrative and confined to the orthodontic problems found in tension athetosis.

The difficulties found in tension athetosis are well pictured by the results from surgical intervention. For example, a patient with tension athetosis has been walking on his toes, and it is decided to relieve this condition by lengthening the Achilles tendon. If the operation is successful and the gastrocnemius can no longer lift the heel, the same patient will now bend his knees until the heels are again off the floor, and a further operation on the knees will be necessitated.

The speech organs are the most frequently affected of all of the areas of the body in cerebral palsy. The most common and the most distressing defect is the speech disorder which occurs. After all, a speechless child will be easier to care for, if nothing else, if he can say when he is thirsty or in pain. Many

of these children die in public institutions simply because they are unable to talk. The reason for the speech organs being affected more frequently is probably because speech is the most complicated muscular coordination of the body, and requires a total function of the central nervous system to bring it about. Therefore, injuries to any part of the brain produce effects upon speech.

In tension athetosis, this is particularly distressing. For example, the tongue is liable to assume a bizarre thrust against the incisors and develop a medial open-bite. No correction will be possible by appliances without some other sort of approach. Goodfriend reported a case of tension athetosis in which the orthodontist attempted to restrain the tongue by means of a wire harness. This harness in three months was imbedded into the structure of the tongue, and the tongue was again pressing against the incisors. The force of the tongue is really quite amazing in these conditions.

It is possible by means of various techniques to produce a measure of change in this patterned picture. At the Institute this is done by means of reflex conditioning of the chewing, sucking, and swallowing integrations. When the tension athetosis is reduced, then orthodontic measures are urgently needed. This is explained because the tension athetosis being reduced now leaves an overt athetosis. In this condition, the tongue constantly moves as long as the subject is awake. It goes forward, backward, upward, changes in size and appearance. The difficulty for speech here is, of course, the fact that there is no starting point from which to learn. In all coordinated, learned muscular functions, we always commence drilling from a single point. In the athetosis there is no single point. For example, in learning to swing a golf club, the legs are placed just so, the feet are turned just so, the head is held just so, the hands are held just so. When there are variants the swing is incorrect. The athetoid can do none of this. He must learn to move quickly as the movement goes by him, so to speak. He has to direct attention in various ways. There are many techniques for reducing overt athetosis, but none are ever corrected. The Institute has developed the most recent of these which consists of Pavlovian conditioning with sound. However, if the athetosis can be reduced to the point where some learning is possible, it is obvious that any further structural abnormality such as a severe malocclusion will make it necessary not only to teach the speech mechanism, but will add the additional difficulties of compensatory teaching. Thus the importance of orthodontic maneuvers.

It is obvious that very close consultation and cooperation will be necessary to produce success.

No complete correction of cerebral palsy has ever been attained. The brain lesion is irreversible. What is done is to attempt to develop compensations by uninjured tissue for the damage. That this can be done is proved by many animal experiments and by long human clinical experience. The goal, therefore, is not normalcy, but vocational self-support. There is no reason at all for this latter goal not to be obtained with a patient who is intelligent and has good emotional and social adjustment.

Obviously, the esthetics of orthodontics become even more important here. The case of cerebral palsy has so many obstacles to overcome in the way of public

acceptance (the public thinks of them as syphilitic, intoxicated, or insane), that the revision of the facial structures to normalcy is in itself most important for the achievement of the goal.

Many of the Institute's patients have graduated from the University. Many are now earning their own living. For example, one of the early cases seen was a boy 9 years old. He could not maintain his own balance, write or hold a pencil, or speak intelligibly. He is now an attorney and doing very well. A young woman is earning her own living baking pastry and doing fine sewing. Another young man is in the newspaper business. Another is an accountant. These are cited simply to show the value of everything that one can do. Orthodontics is one of the most important tools the logopedist has for bringing the right to search for happiness to these neglected cripples.

The Institute has a full-time program. Work is also done with veterans with head wounds, patients after strokes who have aphasia, stutterers, severely speech-inhibited children, speech after removal of the larynx, etc. But perhaps enough has been given to illustrate the need for close work between the two professions.

A word of caution needs to be brought in at this time. Speech correctionists are generally not licensed in the various states. This is an educational profession. Unfortunately, there are numbers of individuals who misguidedly, perhaps, have found that there is a very great need on the part of these handicapped persons, and that they are willing to pay for any sort of attention. There is a professional organization in this field which has set up professional standards, the American Speech Correction Association. The Association requires five years of college education and four years of supervised clinical work before an individual is considered qualified for this field. Our own office has been engaged in this standardizing work for many years, and lists of the competent people are available. An orthodontist wishing this service for his clients would do well to investigate through our office the records of the American Speech Correction Association. I may say in passing that this is standard procedure with the American Medical Association, and that an accepted list is furnished the American Medical Association each year by the American Speech Correction Association.

Orthodontics and speech correction together may very well mean the happiness of any given child. Certainly no child today needs to grow up in a speaking world, shut out, walled out from friends, real life, happiness, and the satisfaction that comes from independence and self-support.

THE PSYCHOLOGY OF FINGER-SUCKING, TONGUE-SUCKING, AND OTHER ORAL "HABITS"

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I AM glad to have this opportunity of presenting to a group of orthodontists the knowledge that has been collected over many years by psychoanalysts concerning the reasons for and the management of finger-sucking, tongue-sucking, and other so-called mouth habits of children, and I am most interested in hearing what you will have to say in discussing my presentation. I said that these data have been collected over many years by analysts and particularly analysts who are especially interested in the emotional problems of children, but I am afraid that heretofore we have been at fault in not making our data more widely known to other specialists in the medical profession. I think the reason for the fault lies in a certain feeling of shyness and timidity in presenting facts whose organic basis has not been well understood. We have behaved in the same way regarding our knowledge about "so-called" psychosomatic medicine. I think it was in the first decade of this century that Freud first pointed out that certain organic conditions were influenced and could even be produced by the patient's emotional conflicts, but it was only during the crisis of World War II that the knowledge collected by such careful workers as Alexander, Dunbar, Saul, Weiss, English, and others became part of the scientific tools of the internist, pediatrician, the surgeon, and the general practitioner.

I am going to introduce my discussion of the mouth habits of children by presenting two cases. I have selected these two from a great many more because they are comparatively simple ones but very illustrative of the problem.

CASE 1.—The father of a 4-year-old girl became very annoyed at his daughter's constant habit of sucking her fingers. Rather suddenly he began rebuking and scolding her, pulling her fingers out of her mouth and even slapping her hands. After this had gone on for a couple of weeks, the little girl stopped her finger-sucking completely, but about two days later began to stutter badly. The stuttering continued and got much worse. Her father was disturbed by the stuttering and realized he had made a mistake. He apologized to his daughter for stopping her finger-sucking, told her it would be all right for her to return to the habit—which she did not do—and encouraged her to suck lollipops whenever she wanted to. After about a week of this regime the stuttering which had been constant for a number of months ceased.

CASE 2.—A 5-year-old girl was a neighborhood problem. She destroyed property, broke windows, beat up the neighborhood children often with a piece

Read before the Annual Meeting of the Northeastern Society of Orthodontists, Atlantic City, N. J., March 1, 1948.

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of iron pipe. She beat up her sister in the same way. She was completely disobedient. She did everything her mother did not want her to and refused to do anything that her mother asked. She used obscene language constantly. She had a predilection for drinking medicine and the chandelier was the only place in the house where medicine could be kept out of her reach. One morning about 3 o'clock her parents heard a noise downstairs and on investigation found the child frying eggs. When her mother angered her, she cut up her mother's best dresses and counterpanes. This behavior had started rather suddenly about two years before. As a young child she had been alert, active, and as conforming as could be expected. She did, however, suck her fingers, and her mother was determined to break this habit. She was scolded, her hands pulled roughly from her mouth, and she was spanked. She continued her finger-sucking. The mother put bitter substances on her fingers but the child sucked anyway. The mother used finger guards but the child took them off. Finally, the mother in desperation, because she was determined to stop the finger-sucking, splinted both the arms day and night. These splints were kept on for nearly a year between the ages of about 2 and 3. When they were taken off the finger-sucking had stopped, but within a few weeks the child's whole disposition and character had changed and she started in her antisocial career.

Such cases raise several questions. Why does a child suck his fiingers? Why is the forcible cessation of finger-sucking followed either by a neurotic symptom as in the first case or by a personality change as in the second? And why in the first case was the neurotic symptom relieved by a return to sucking? I shall try to answer these questions in order.

There are certain parts of the body, the lips, mouth, anus, finger tips, and genitals, that are richly endowed with sensory nerve endings. Stimulation of these nerve endings by a stroking or slight scratching stimulus gives a marked feeling of pleasure. Once this pleasure is felt, there is a desire to have it repeated. The desire for this pleasure also arises from the presence in the blood of substances apparently produced by the sexual glands because in adult life when sexual desire is present, touching of these parts is desired as a phase of the act of intercourse. Children also have the desire to have these parts of the body stimulated in order to get the pleasurable feeling. The desire to suck for pleasure is not due to the need for food because x-rays of the fetus, where the child could not possibly be hungry, sometimes show it sucking its fingers. Also, babies will suck their fingers after a full meal. In the late twenties, Levy studied this phenomenon and he found that children who persisted in finger-sucking over a long period of time were children who had bountiful mothers or were bottle-fed with too big an aperture in the nipple. Instead of having to suck to get food, the milk ran down their throats and their need to suck was not gratified. Later, he separated a litter of puppies into two groups. The first group were allowed to suckle; the second group were fed with an eye dropper. Both groups got the same amount of food but the puppies who were fed artificially began to suck their paws, each other, and the furniture, while those who were suckled did no other sucking.

It appears therefore, that the need to suck is a separate function of the animal and does not have any relation to the need for food. Ribble from her studies on babies stated that the average child needs a minimum of two hours a day of sucking, and she pointed out that an adequate amount of sucking develops the muscles around the mouth and eyes and so increases the child's good looks and later on helps the method of speaking (because it helps the establishment of rhythmical respiration) and the ability to grasp objects.

In the early 1920's, Abraham reported careful observations on the later results of curtailment of infantile sucking and infantile breast-feeding. He found that if either was curtailed too much, the child later developed a particular type of personality. Such a child tended to become very jealous, selfish, grasping, always discontented and never satisfied, always with a chip on the shoulder because he was so sensitive and easily hurt, and always expressing the feeling that he never had his rights, regardless of how beneficent fate was to him. It was found, also, that such a child was unable to obtain adequate gratification in his adult sexual life.

The following case is illustrative of this:

CASE 3.—When the patient who is now an adult was a little girl, she suffered a series of emotional traumas. Before her sister was born, when she was 4 years old, she had sucked her fingers but the sucking had been stopped severely by her mother. Because she gave in to her mother, she clung in a babyish fashion to her and had no trouble until her sister was born. Her babyish dependence made her very unhappy when the mother turned her attention to the new baby. The patient, feeling lonely and neglected, as she was in fact although because of her infantile dependence fostered by her mother's objection to her finger-sucking, she felt more neglect than really happened, tried to return to her finger-sucking to give her comfort and happiness. She did not dare to suck her fingers so instead she sucked her tongue. Her mother detested this and stopped it by rubbing the child's tongue with red pepper. More neglected and unhappy than ever, the patient turned her infantile dependency to her grandmother. The mother objected to this, said the grandmother was spoiling her child, and sent the grandmother away. The patient could not suck her fingers or her tongue, so she developed a habit of clutching at her neck—a gesture that expressed distortedly her wish to put her fingers in her mouth, her fear lest she do so, a desire to be hugged and to hug her mother, and a desire to choke her mother or herself. This gesture continued into her adult life and was most disturbing to the patient when she found she could not stop it. She remained infantile and dependent on her mother's estimate of life which she had taken over completely. It was wicked to get angry, to hate, to love, to want anything done for her, to get any pleasure out of life, etc., and so she became a very unhappy woman with few friends and no love life.

I have tried to demonstrate that the desire for finger-sucking is a need like hunger which every child has. Because it is a need like hunger, we can say only that it has an instinctual basis, by which we mean that we do not know what its basis is but we know empirically that it exists and its gratification is

necessary for the child's development. If this gratification is stopped forcibly, then the results which can occur depend on the type of child. The passive child gives in to the parent's demands, attempts to conform to please them, and remains infantile and dependent, like Case 3. The less passive child attempts to conform to please the parents but like Case 1 develops a symptom that indicates her wish to get some pleasure from her mouth but is afraid to because it has been forbidden. If the child has great courage, as in Case 2, he resists the parent's restriction until he has to give in, when he begins to hate his parents and develop a character antagonistic to all authority. These reaction patterns once laid down continue into adult life and in the first two cases cause the individual all kinds of suffering and in the third cause the individual to make his environment suffer.

The need to suck being an instinctual drive, its degree varies in different children. Some children relinquish finger-sucking of their own accord very early. Others continue for a moderate length of time. Others again continue to do so for a number of years and then of their own accord gradually give up first in the daytime, later after they get into bed, and still later they still continue it after they fall asleep. Eventually they relinquish it entirely, when they are ready emotionally to do so. Some of the latter cases result from lack of adequate feeding in infancy and some from the lack of adequate mothering during the same period. In other cases, the need to finger-suck seems greater than usual as a constitutional trait. Draper has pointed out that because of constitution, certain individuals, if they get a gastrointestinal infection, will suffer from an acute appendicitis, while others for what seems the same reason will suffer from a cholecystitis. Difficulties in toilet training and speech defects seem to run in families, i.e., they have a constitutional basis. Similarly, constitutionally certain families show a greater need to finger-suck. Abrupt deprivation of gratification of this need causes these children more emotional trauma than in patients in whom the constitutional factor is less.

There are two types of finger-sucking. I have just mentioned the first in which the finger-sucking continues from birth for a varying period of time. In the second, the child has relinquished his finger-sucking himself and without any need to conform to the parent's dislike of it. Later, perhaps, after four or five years, the finger-sucking starts again. This type of finger-sucking has the same etiology as the similar type of enuresis and, in fact, of any neurotic symptom or of any perversion. The child has met some difficulty in his present emotional development, is unable to develop further, and goes back to an earlier form of gratification. The problem is not how to stop the finger-sucking but what has happened recently to stop his development.

Case 4.—This girl of 12 told me that when she sucked her fingers she felt comfortable but when she did not suck them she was troubled by the sexual thoughts she had. In order to stop these sexual thoughts, which were simply the ordinary sexual curiosity of any child of her age but at which she was very horrified, she sucked her fingers. Her problem, therefore, was why she was so horrified by her perfectly natural sexual wonderings. I have known a number

of adults who have sucked their fingers until well into adult life, even in two cases after marriage. Of course, they all were horrified at having such a habit.

CASE 5.—A married woman of about 35 years of age continued to suck her fingers. Her marriage was a rather unhappy one and her sexual life was unsatisfying. Even after her marriage she still felt infatuated with a man whom she had known for two years when she was 21 years old. This man later married another woman. As far as she could remember, she had sucked her fingers all her life except for a period of several years in her very early teens. During this time she was having sexual relations with her brother, who was redheaded. She stated that she had been willing to respond to his advances because he did not tease her about her finger-sucking. When fear of discovery and of pregnancy caused her brother to desist from these relations, she started to suck her fingers again.

Her real problem lay in her strong but unconscious attachment to her brother and in her guilt about these sexual relations which she had displaced into her sexual relations in marriage and onto all her sexual desires. As she felt guilty about having any sexual desires, she had no real love affair. Her marriage had been an attempt to overcome these guilt feelings. However, the guilt feelings were still present. She was too guilty to be able to make an adult sexual adjustment, so she continued to try to obtain sexual gratification from her finger-sucking. Only when she was getting sexual gratification from her brother could she desist from the pleasure of sucking her fingers.

In all the cases in which finger-sucking has been continued into adult life, there has been a psychic conflict in the adult sexual life and when this was solved the finger-sucking ceased automatically.

I have tried to show that there is abundant evidence to prove that finger-sucking is a necessary part of the life of young children and that if this method of obtaining instinctual gratification is stopped too abruptly or too severely, the personality of the child and of the child when he grows to be an adult becomes distorted and the original work is laid for a future neurotic illness or for anti-social behavior. I am re-emphasizing the fact that it is not only the struggle between the child and the very strict and unreasonable parent—a struggle over every item of the child's life—that causes the deformity of the child's personality, although this struggle does have such an outcome, but, also that if the struggle is over the child's desire to gratify his need to suck, it is a more important one than if it were over the question as to whether the child will dress himself or not. However, does finger-sucking if undisturbed until the child is able to relinquish the gratification himself as part of his normal development result in facial and dental deformities? Levy in his study affirmed that it does not do so unless the child sucks constantly the two middle fingers of the supernated hand, which position is very rare. As far as I can determine, facial and dental deformities most commonly result from constitutional characteristics or conditions which impede adequate breathing such as adenoids. I feel that these two causes are more etiological for mouth deformities than finger-sucking or even than the placing of babies in the prone position in order to relieve flatulence as Hahn has thought.

I am going to discuss several other groups of facts about the mouth which every dentist should know if he handles many children in his practice.

Nail-biting is a very common habit in America. At the Induction Board I discovered that over half of the draftees either had a history of nail-biting or bit their nails still. It was such a common habit that many psychiatrists stopped inquiring about it. Is it a neurotic symptom? Lesse, who was psychiatrist in one of the Submarine Training Centers, found that men with a history of nail-biting or who were nail-biters did not make good crew members of submarines, so that it would appear to be a symptom of a neurosis. As far as I have been able to observe, nail-biting begins either when finger-sucking or masturbation is stopped forcibly by parents either by threats or punishments. It, therefore, is a substitute form of these two satisfactions for certain pleasure needs. Often the nail-biter bites so vigorously that his fingers become sore and infected. This does not appear to be the satisfaction of a pleasure need. However, many children and adults, if they are angry, will hit or bite themselves rather than express their anger openly. In several cases, I have known children to bite themselves so seriously that they drew blood. This always happened in a situation where the child was angry, although in some instances the child did not perceive consciously his feeling of anger. Nail-biting, therefore, expresses two impulses: a desire to finger-suck which has been forbidden, and a feeling of hatred to and a desire to bite the person, usually one or other parent, who has forbidden the finger-sucking. The more that parent nags and objects to the nail-biting, the more severe the nail-biting becomes as an expression of the child's annoyance. Experience bears out this fact constantly.

Nose-picking sometimes accompanied by eating of the nasal mucus is another rather common habit of American children. It may be a substitute either for forbidden finger-sucking or forbidden and therefore dreaded masturbation. It may result also, and often does, from an earlier habit indulged in often by parents. In the interest of "so-called" cleanliness, these parents regularly and consistently perhaps several times a day have swabbed out the child's nasal openings. This frequent swabbing has gone on for a number of years. When it is stopped the child feels the loss of the feeling of pleasure produced by the swabbing and wants it repeated. As he has no swab to do it for himself, he uses his finger. If the latter circumstance is the cause, it will be necessary to help the child very gradually but firmly and consistently to relinquish the pleasure he finds in picking his nose. If the nose-picking results from a fear of punishment for finger-sucking or for masturbation, it will be necessary to treat the child to determine the cause and so remove it by removing the child's fear of these activities.

There is another group of data which I think will be of interest to the orthodontist. The teeth, and particularly the mouth, have certain psychologic significances. Immature human beings are very primitive in their concepts and react emotionally not to reality but to their primitive ideas.

Teeth are an important part of the body to all primitive peoples, as are all other body parts; e.g., the teeth, the hair, and the excreta all contain part of

the individual's life and if any of these parts are lost or fall into the hands of an enemy, witchcraft can be performed on the part, and as it is destroyed the life of the part and the life of the original owner both are destroyed. This is the real origin of the custom of placing an extracted first tooth under the pillow at night so that the good fairy will come, take the tooth, and leave a sum of money, which used to be ten cents but now I believe has risen to one dollar, in its place. The child has given up a valuable part of himself and must be recompensed for his loss in coin of the realm. Such an idea of the value of teeth is expressed in the Songs of Solomon: "Thy teeth are like a flock of sheep that are even shorn which come up from the washing; whereof everyone bear twins and none is barren among them." To a nomadic group of herdsmen the most valuable possession were their flocks and herds, and therefore one can see the value they set on teeth.

American adults in their dreams place a similar high value in teeth for they regularly are equated with a child or a penis and the common dream of a tooth falling out is associated regularly with ideas of childbirth. The individual can bear the idea of a loss of a tooth by imagining that he has produced another living person from his body as a compensation.

Therefore it is natural to expect that the child, particularly a young child, will fear to have the dentist look in his mouth lest in some way perhaps by magic, he will spirit away one of his teeth. This is one of the reasons that both children and adults dread dental attention, even though they have never experienced any pain in the process.

If the child when younger has been a biter, he may fear the dentist more because he expects he will be punished for his "bad" behavior by absolute justice; i.e., he who uses his teeth badly will lose them, and the dentist is a person by whom teeth are removed. Several years ago I knew a boy of 3 who refused to eat any solid food whatsoever. His meals always had to be puréed. When he was younger he had been forced to play with a slightly older child who domineered over him. He retaliated by biting and for this was severely punished; as so often happens, the real offender, the other child, went scot free. From that time the child became afraid to use his teeth at all and the eating difficulty developed.

Not only do the teeth have a special psychic significance but so does the whole mouth area. Every reliable pediatrician knows that children tend to resist any examination of the mouth more than they do practically any other part of the body, and they know that usually it is best, if they wish to make their physical examination careful and thorough, to leave the examination of the mouth and throat until the last. Winnicott in London has shown that if something such as a spoon or tongue depressor is introduced forcibly into the mouth of a young baby, i.e., under 1 year, the child immediately will have a severe attack of colic. This results from the fact that all the emotional reactions and desires, love, hate, cruelty, aggression, passion, curiosity, etc., which we as adults feel in various parts of our body and express by the use of many organs—hands, eyes, etc.—are felt and expressed by the little child largely through the medium

of his mouth. In his mind all ideas and concepts associated with these feelings and desires involve the use of his mouth as the principal vehicle of expression. One little girl who was very fond of me and who felt very lonely when she was away told me that she wished I were lamb chops so she could eat me up and never have to leave me. Here the feeling was one of love and the vehicle of expression was by the use of her mouth. A boy wanted to capture me, tie me to the stake, burn me alive, and eat me. Then he could perform the magic that he thought I did. In this play he expressed his envy, his jealousy of me, his desire to conquer and master me, and the only way he felt he could do so was through the use of his mouth.

Both of these children, and I cite these examples not because they are unusual but because they demonstrate the usual fantasies of children, illustrate the basic principles of the usual cannibalistic rituals. The enemy is eaten only if he is brave, and his courage then enters into the individuals who have devoured him. I am quoting these examples to show you the fact, well known to all psychoanalysts, that human beings, particularly children, have many fantastic ideas about their mouths and resent an examination of their mouths because of these ideas.

What is the practical significance of these data? Every child who comes to a dentist is frightened of the dentist because of the ideas which I have just described about his teeth and his mouth. Terribly frightened, he is required to undergo an examination of his mouth. He cannot react to his fear by the ordinary biologic ways. He cannot run away as he may want to—his parents and his pride forbid him. He cannot beat the dentist up as he may want to—his parents, the dentist's greater size, and his good manners prohibit that. He cannot freely express his fear—his conscious knowledge of the situation, his parents, and his pride prevent that. He goes through the dental treatment like the little gentleman he is, but suffering untold agonies. It should be clear to everyone who has had any experience in the services that such a situation, i.e., when the individual is terribly frightened and upset but cannot express any of these feelings because he must conform to what is expected from him, is a very harrowing one and one that so frequently produces neurotic, i.e., undesirable—defense reactions. What does the child do? He may go home and have a nightmare that night, an anxiety attack that day or the next, or he may behave badly for the next few days. Often, however, intuitively he may be able to find a valid method of releasing his uncomfortable feelings. He goes home, sets his younger brother or sister in a chair and operates on his brother or sister's mouth. In his fantasy he is the dreaded and dreadful dentist and the younger sibling is himself. By this method of changing passive suffering into active aggression in play, the child abreacts his uncomfortable feelings. Of course, if the dentist has had to hurt him, the difficulty of making an adequate abreaction is increased greatly. This method of self-devised therapy forms a large component of children's play, and has been incorporated as a valid and successful therapeutic procedure in the psychiatric treatment of children's neurosis. Time and again I have had the experience of having a child patient come to his treatment

hour just after visiting the pediatrician who has given him an injection. Under these circumstances I anticipate usually that the child when taken to the playroom will seize a doll and any sharp-pointed instrument and thrust the latter into the former's eyes, mouth, ears, body, extremities, and genitals with great glee, often saying that the doll represents Dr. So-and-So. After such a piece of play, the child goes home, at peace with himself, not liable to suffer any nightmares, and able to be on good and less-afraid terms with the pediatrician next time he sees him.

During a visit I made to Berkeley, California, about a year ago, I was much impressed by the recognition of the need for such types of therapy by several pediatricians and dentists. They were very interested in trying to work out how such therapy could be part of the child's visit to their office so that he could leave in a less anxious frame of mind than when he came. They also were experimenting with a plan whereby the child would find the first visit less frightening. If the child seemed frightened and there was no serious emergency, he was taken into a playroom by a very motherly nurse who played with him for a short time. If this did not eliminate the fear, the child was sent home to return later when the same procedure was repeated until all signs of fear had vanished. Then the medical examination began. They were considering very seriously how they could arrange for the child to abreact his emotions, in the way I have described, after injections or dental treatment.

CONCLUSIONS

1. Finger-sucking is a necessary means of gratification for young children.
2. If stopped severely or suddenly, deformity of the personality develops.
3. It does not deform the mouth or face.
4. There is a special psychologic significance to the mouth and the teeth.
5. Children's dread of oral and dental examinations is connected with this significance.
6. Abreaction of the suppressed emotional reactions during medical and dental examinations and treatment is a needful part of the whole therapeutic procedure. Otherwise, acute anxiety may develop.

DISCUSSION

Dr. Angus F. White, Jr.—What relationship is there between thumb-sucking and fingernail-biting?

Dr. Pearson.—I was going to talk a little bit about fingernail-biting. When I did induction board examinations I had the same experience as every other psychiatrist had: that fingernail-biting was so common among inductees that well over 80 per cent of all inductees bit their fingernails, and one came to the conclusion that perhaps this was not a neurotic symptom. On the other hand, a friend of mine who was working in the Navy with people who were to go down in submarines found that men who bite their fingernails do not make good submarine sailors. The cases of nail-biting I have seen very often follow the forcible cessation of finger-sucking. The child becomes furiously angry at having the finger-sucking interfered with, gives in, then has the desire to bite somebody in retaliation. He does not dare bite other people so he bites himself. I have seen that proved with children very often. I remember a number of cases where if the child would get angry with me, he would never

give any sign of it at all but would bite his own arm until the blood came. I think that is what happens with this very severe nail-biting habit. The child is a very angry child, and is afraid to express any anger. The nail-biting, therefore, is a neurotic symptom, but it is so common in America today that we either must say that all inductees who bite their nails are neurotic, or say it is not quite as severe a neurotic symptom as we thought it was.

Dr. Arthur L. Smith.—If nail-biting and especially if thumb-sucking persists, at what stage of development or at what age do you feel we need to step in or need some help in order to correct it?

Dr. Pearson.—I would say this, and this is purely empirical, and simply out of my own experience, that if a child of 4, 4½, or 5 continues with his finger-sucking, it might be well to look into the family situation. Is this child actually being well treated? Is there a marital problem between the parents which is going on, and the child is becoming more and more uncertain as to how long the parents are going to stay together? Is there an awful lot of quarrelling in the family? Has one or the other spouse been away too long? Is there something upsetting the child? If there is, it has to be corrected, and that is all that is necessary. If at the age of 6 or 7 the finger-sucking still continues, then I would want to get a pretty good history of how this child has been dealt with all the way through his life to see whether he is one of those who would give up finger-sucking by himself or where you would have to come back to the cause of some neurotic difficulty, the neurotic difficulty developing in the family situation, and first cure that. So I would say at probably 4 or 5 one should have the situation studied. If it continues longer than that, I would definitely have the child treated to see what the matter is.

Dr. Bernhard W. Weinberger.—You made a significant statement in the beginning that you have observed in taking radiographs of fetuses the sucking habit back in that stage. I believe it was about 1918 or 1920 I made the statement at one of the meetings that we had two types of thumb-suckers: the one who is born with the habit and the one who acquires it at or immediately after birth. The one you can break; the other you cannot.

Continuing the thought that you just brought out, is there not a possibility that with that one who has acquired it prior to birth you cannot at any time break, and that it would not be advisable to attempt to do that? However, in the other case they will naturally stop on their own and of their own accord when they reach that stage, so it is not better to interfere with them either?

Dr. Pearson.—I entirely agree with you. Of course I am in the same situation as the psychiatrist is in when there is put up to him the question of constitution versus environment. He cannot say he does not know enough about what constitution is. I am pretty sure myself there are constitutional thumb-suckers. It is very difficult to break them, and if they are broken they may develop very marked symptoms as a result. I think the others give it up pretty much themselves, as you say. Certainly, one has the so-called oral types of human beings, who are either constitutionally based or suffer from such severe deprivations in the first couple years of life that they have to continue their oral traits. With those types of people, even with adults, one has really to work through a great deal of oral material, oral psychic material, before he is able to have them come to terms with living like other human beings.

Dr. Ellis Morris.—I would like to know whether a psychiatrist has ever studied the development of the personality of a youngster when that youngster becomes conscious of his malformation due to sucking.

Dr. Pearson.—Oh, yes, and that brings up, of course, another difficult problem for the psychiatrist. You have on top of whatever the child's own difficulties are, whatever they may be, the secondary problem of his feeling very inadequate because of his mouth deformity, and certainly those things are very difficult to handle by the child patient. However, I think that they are more easily handled in the stopping of the finger-sucking, though they are difficult.

THE ROLE OF ORTHODONTICS IN ORAL HEALTH

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WE MUST ever keep in mind our aim or goal when we start treatment for correction of any pathologic condition or deviation from an accepted normal. This is true in any of the healing arts, whether it be general surgery, orthopedics, prosthetics, restorative dentistry, orthodontics, or any of the other branches. None of the healing arts is completely divorced from any single one of the others, no matter what the instance. I feel this to be true in *every case* without exception or qualification. Too often in this age of specialization, the operator becomes so engrossed and self-centered in his own particular field that he is guilty of neglect in surveying and correctly appraising the over-all case. This is inexcusable neglect equal to complete inadequacy on the part of any operator in undertaking a task which he is incapable of performing successfully.

We, as dentists, are specialists in the maintenance and restoration of the oral cavity, both physiologically and esthetically. In carrying out this work we must never forget that we are responsible to the patient, ourselves, and society for this part of the whole being. It would be folly to deal with one part of an integrated machine and ignore the over-all structure at the same time. One could build a perfect spoke, precise in every detail, which would be utterly useless if it were of too great length to be in harmony with the whole wheel. Similarly, when you prepare a cavity and restore a tooth, it *cannot* be accomplished without taking into consideration the numerous adjunctive factors which you understand and know far better than I. You must never forget, however, that the restoration is merely a part of the tooth, which is only a part of the dentition, which in turn is only a part of the individual. Evidence has been established that any disturbance in the masticatory apparatus is often reflected in other parts of the body, and it is a recognized fact that disturbances in other parts of the body are reflected in the teeth and supporting structures. If the masticatory apparatus is seriously impaired in its efficiency, then the digestive tract is also impaired in *its* efficiency, due to increased demands on its other integral parts.

It is highly alarming and discomforting to have to admit that there are some orthodontists who have overlooked these facts. Some have gone astray to such an extent that they seem to have forgotten that esthetics is not our only aim in treatment. Let me repeat this. Esthetics is *not* our only aim in orthodontics. There has been so much ill-advised publicity (and I mean *exactly* that) given to straight alignment of the teeth that orthodontics is actually *re*gressing rather than *pro*gressing in some of the offices in this country. When a practitioner has gotten to such a closed frame of mind as to forget that the over-all

Read before the Cincinnati Dental Society, Annual March Clinic and Children's Dental Health Day Meeting, March 16, 1948.

picture of harmony and function and balance must be his primary goal, it is time for him to retire. After thirty years of practice and attempting to choose *what is right so that we may go forward,* I cannot understand how a *great deal of that which has been shown as true can be discarded.* It is *absurd* to think that we would advocate that all mouths should be the same, and yet there are those who are doing *just this* and attempting to justify themselves that in so doing they avoid later relapse.

Orthodontics has somehow gotten itself in the *impossible* position wherein patients (and many dentists) think a case is a failure unless the anterior teeth are in perfect alignment and stay exactly that way for the rest of the natural life. In no other branch of medicine has any such impossible result come to be the criterion of success or failure.

From everyday general observation and without being egotistical, I feel that the orthodontist is doing his work about as well as the men in other lines of dentistry are doing *their* work. There are too many variations to be dealt with in orthodontics, as well as in prosthetics, for either to be an exact science. LeRoy Johnson is about right in feeling that 100 per cent absolute perfection in occlusion is a myth. Many have come to believe that absolute perfection is what should always result. Any prosthodontist is faced every day with the problem of talking his patients out of demanding too perfect alignment of teeth so that they will not have an artificial look. Yet we are supposed to give every patient exactly that—*a perfect set of teeth.*

Patients are not unreasonable unless they are misled into expecting more than results will show later. The dentist making a bridge takes into consideration mechanical and physiological function and durability, as well as esthetics. He explains to the patient why these are just as important if not more important than esthetics alone. The plastic surgeon does not replace the lost ear or portion of tissue so that it is better than the original, and yet we applaud his results. They are in harmony and functional.

We must always keep in mind that there is no such thing as a normal occlusion or perfect occlusion *in its restricted sense.* Rather, we must think of what is normal for the individual. If nature had intended one absolute normal, then we would all look exactly the same. To assume that what is normal for a thin, slight man is normal for a stout, husky individual is utterly ridiculous. Each *may* be normal for his type. This is known as "individual normal." How contrary to all we know or have learned is the theory that *all* occlusions should be exactly the same.

Some men are extracting all four premolars in as many as 90 per cent of all their cases with utter disregard as to whether the face is one type or another. *These patients are told how "straight" their teeth are!* The fact that vertical dimension is lost, periodontal disease invited in the spaces thus acquired, and fullness of the cheeks and lips gone is callously disregarded. These very conditions created at a comparatively early age by some orthodontists are identical with those which the periodontists are most concerned with correcting at a later age. *Is this what is best for the patient and what we are striving for?* I think not.

There has been much discussion concerning optimal time of treatment and again it is most distressing to note the disregard of all that has been taught through experience. Some of you may have read my short editorial in the May, 1947, issue of *Dental Survey*. In this I mentioned preventive orthodontics.

Let us briefly go back over the history and progress of the healing arts. In the earliest writings we are able to find mention of superstitious cures for disease. Even after centuries had passed there was little progress except that through time and trial and error better medicaments were found for healing purposes. It was not until comparatively modern times, beginning with Pasteur, that great strides were made. With Pasteur began the study of preventive medicine. Dentistry has been much slower to follow, but the greatest period of advancement in dentistry has been the most recent in which *preventive dentistry* has become a leading subject for research.

Orthodontics should be primarily a preventive treatment rather than a corrective one. The old adage, "an ounce of prevention is worth a pound of cure," was never truer than in this field. In medicine we do not wait until a simple case of pneumonia has progressed into a complicated one of double pneumonia before treating. Nor are we supposed to wait until a cavity has involved the pulp or destroyed the tooth before arresting the caries. Such procedure is so unheard of as to be ridiculous, and yet in orthodontics there are some who advocate *just such waiting*. Again, *there* is the distressing evidence of not taking the whole well-being of the patient into account.

The time orthodontic treatment should begin depends upon the individual case. However, in my thirty years of experience I have seen no case in which I would have deliberately waited until the patient was *more* than 14 years of age to treat. I have seen very few which I think should be delayed *that* long. In all cases, however, it is desirable to observe the case as long as practicable before beginning treatment. This last is *unfortunately often impossible* since we usually see the patient after the malocclusion has reached a rather severe degree. This is too often due to the neglect of the pediatrician or pedodontist or the general practitioner in making a thorough diagnosis of the patient when beginning treatment at one of the early periodic checkups. An occlusal deviation from individual normal at any age is sufficient to indicate an orthodontic consultation. The practitioner often lamely excuses himself that he never sees the patient with his teeth in occlusion. No licensed physician or dentist can conscientiously excuse himself from his duty regarding his patients' *over-all* welfare.

There is *no* ironclad rule which will guide us in our decisions as to the optimal time of treatment. In order that we may be of best service to our patients, there must be a general criterion established which may serve as a basis for determining when to begin treatment. Therefore, I have attempted to outline briefly the types of deformities which should be treated in the primary or deciduous dentition and in the mixed dentition.

1. Cases to be treated in the primary dentition and one example of each:

a. Cases in which an etiologic factor is discovered which is not eliminated will produce an incipient deformity: One such example would be shown in a

distoclusion case with protruding maxillary incisors, extremely high narrow palate, narrow arches, open-bite, and associated thumb-sucking and tongue-thrusting habits. There is much pro and con discussion as to whether thumb-sucking is an etiological factor in malocclusion, unless continued after the third or fourth year. If continued until these ages, however, there is *so often* an associated tongue-thrusting habit which, if allowed to continue, will cause an open-bite and enlarged tongue which may never be successfully dealt with by orthodontic treatment.

b. Cases in which caries or accident has caused early loss of deciduous teeth and there has been drifting and closure of resultant spaces: Such an instance might be that in which the mandibular primary cuspid is prematurely lost and the mandibular arch has collapsed and the space lost. These cases are sadly neglected in everyday practice. A space retainer would suffice if used before the drifting has begun. If malocclusion has resulted from such neglect, the optimum time for treatment is as early as possible before the permanent dentition has a chance to erupt without sufficient space. Relatively short treatment, followed by some sort of space retainer, will nearly always suffice in such cases. *We would truly be preying on the public to allow such cases to go untreated until permanent dentition was fully erupted, and then extract one or more teeth along with complicated treatment.*

c. Cases in which the mandible is in a forward, backward, or one-sided relationship to the maxilla: Children with protruded mandibles and lower incisors in labioversion to maxillary incisors are the greatest offenders in this category. If these cases are not treated in the primary dentition, they can never be brought to a truly desired and successful occlusion. These children when untreated will go *100 per cent* from bad to worse. The mandible is stimulated to overgrowth while the maxilla is underdeveloped. Whenever these cases are observed, treatment should begin *immediately*, without exception, even in hereditary cases. What chance in life has a child with a crippling deformity such as this to inhibit his personality and make him self-conscious when he is with his own friends?

d. Cases in which one or both sides of the posterior segment of the mandible are in labioversion or extreme linguoversion to the maxillary opposites: These are so-called cross-bites and result in over- or undergrowth of the mandible as in the last case. These cases all too often go unrecognized through carelessness and cannot be nearly so easily or successfully treated in the permanent dentition. It is true that in *rare* cases these correct themselves, but it should be up to the orthodontist to make *this* decision.

These aforementioned conditions would also apply to the mixed dentition stage of oral development but, in addition, the following should be treated.

a. Cases in which there is a pronounced closed bite: These cases will not correct themselves but rather are usually worse in later years and extremely difficult to treat in older patients. If treated in mixed dentition stages, it is comparatively easy to open the bite and allow the erupting permanent teeth to grow to proper and normal vertical dimension. The facial contour is allowed to fill out without premature wrinkles and lines about the mouth and chin.

b. Cases in which the mandible is displaced so as to be in distal or retruded relation to the maxilla: Such cases are the center of much controversy since they are repeatedly considered as due to mesial or forward drifting and protrusion of the maxillary teeth. The following has long been assumed to be true:

> The tuberosity rests against the descending pterygoid process of the sphenoid. This process grows downward and forward some fifteen millimeters before it stabilizes so that the backward growth of the maxilla is *actually* transformed into a forward movement of the entire bone and this is further increased by the amount of growth of the pterygoid process.

Diamond has shown in a recent article how his investigations have demonstrated that the maxilla is *not* "shoved forward" as growth takes place in the posterior region. Evidence was presented that, instead, the posterior regions of the maxilla are found lateral and posterior to the descending pterygoid processes during all the stages of growth from fetal stage to maturity. These findings would seem to leave *without foundation* much of the work showing such continuous and extreme forward and downward growth of the maxilla. This has been primarily based on the assumption that the descending pterygoid plates remain, at least anteroposteriorly, in a fixed position. This obviously is not true, since the base of the skull is constantly being remodeled and increasing in size. If the maxilla were "shoved forward," it necessarily would carry with it all the bones articulated with it. These would include all the bones of the face.

This again lends support to a policy of *not extracting* upper teeth until *after* growth is complete, at the age of 20 or 25. Much of this so-called protrusion in children is evidently a manifestation of retarded development of the rest of the bones of the face, with a mere *illusion* of *protrusion*. *When the child reaches the age of 24 or 25 he will hardly praise the orthodontist who improved him temporarily at the expense of a malformed face for the rest of his life.*

In my practice, hundreds of these distoclusion cases have been successfully treated in the mixed dentition stage, and they have been successfully retained. These cases are often the result of the early childhood habit of retruding the mandible and occluding in *that* position for *convenience* and *comfort* due to disharmony or dysfunction in the opposing arches in primary dentition. They may also result from a difference in the growth rate of the maxilla and the mandible. When treated in the growing child, we are merely bringing the forces of mastication and occlusion back to the individual normal. There is no discomfort or tendency for the muscles to cause these cases to revert back if treated so that the new occlusion is established correctly. Where the muscles were formerly flaccid they are now in good tone and the child can develop normally. The mandibular teeth are released from the crowded, jamming occlusion, and the mandible is aided in developing to its normal fullness. *We should not wait and be forced to treat a more complicated case which we helped develop by negligence.*

When treatment is delayed until the twelfth or thirteenth year, much advantage is lost and in some few cases extraction is indeed the last resort. When we fall back on this last resort, the teeth may be lined up and appearance improved, it is true. Always this is a compromise procedure. The vertical dimension is frequently reduced and many of these same features are produced which

the periodontist and then the prosthodontist attempt to overcome later on. Only the wonderful capacity of nature to adjust and compensate in the young allows us to get by even with these compromise cases. *Extraction as a last resort is nothing new, and it was discarded years ago when some of the leaders admitted their long-run failures by this radical and always compromise treatment procedure.*

c. Cases in which growth and development of the maxilla and mandible have not kept pace with eruption of permanent teeth, with resultant crowding and lack of sufficient space for normal eruption. A case that is often seen is one in which the lower lateral incisor erupts rotated or to the lingual. These cases should usually be treated or *at least* placed under observation of the orthodontist immediately. *Never,* under any circumstances, should the primary cuspids be immediately extracted to make room for the lateral incisors. Some of you may have heard or read the paper delivered before a dental group, in May, 1946, by a well-known orthodontist in which he stated:

> The permanent correction of such malocclusions will almost invariably require the extraction of four first bicuspid teeth. Hence the early treatment of such cases, by orthodontic procedure, is wasted time, effort, and expense. One must wait until the permanent buccal teeth have erupted before beginning orthodontic treatment.
>
> However, temporary improvement in tooth alignment in the lower denture is possible and justifiable in the mixed denture stage. This can be obtained by extracting the lower deciduous canines.

This statement is in *direct opposition* to all which I have learned and found to be true in my practice. With proper simple appliances and gentle physiologic pressures, the teeth may be moved and bone stimulated to renewed growth. Wrapping of feet of women in the Far East demonstrates restricted growth, resulting from lack of proper stimulus.

Advocates of such radical treatment do so with complete disregard for the welfare of their patients. I do not find this "invariable necessity of extraction at a later age" to be true in these cases when treated correctly by simple appliances using gentle physiologic pressures. Rather, when treated at the optimal time, they show very gratifying and stable results. The facial outline is pleasing and in harmony with that physical stature of the particular patient. There is no effort on my part to make these patients have a so-called "flat puss," with drawn lips and lines, resulting from the pushed-in appearance. Nor are these patients the potential chronic periodontal patients or future clients for inlay work to gain vertical dimension in later life.

It is nearly impossible to treat mixed dentition cases by *any present-day multiple band technique.* I feel sure that this is a large part of the reason for such statements *that mixed dentition treatment is a failure. It is rather a failure on the part of the operator to master a technique which will permit him to give the patient the service to which he is entitled.* If appliances, *simple in construction but precise in function,* are properly used, teeth can certainly be moved bodily, even though the writer quoted above stated in the same paper that this

cannot be done. Such bigoted statements have *no* place in orthodontics, if we are to progress. *If failures persist with a proved technique, it is the operator who is at fault, not the technique.* Our aim *should be not who is right,* but *what is true.* I do not condemn other techniques as being unsound. It has never been my policy to attempt to smear the successful work of another man. Such mud-slinging tactics are not in conformity with anything advocated by organized dentistry. *I am, however, getting awfully tired of others who seem to know little about the fundamentals of orthodontics advocating, and even teaching, that all other techniques except their own are completely wrong.* Such tactics are identical to those used by communistic organizers. However, as an eminent surgeon once said, "When men agree, progress weeps." Such disagreement must certainly be based on scientific knowledge, nevertheless, and it is thus that I am disagreeing with diagnosis and treatment planning and ultimate patient welfare, rather than method of treatment. I have spent considerable time dealing with these factors, but I feel it is a very important condition concerning which there is much confusion.

Nearly any case can be treated in the permanent dentition. However, these cases are nearly always more difficult to treat since they have been allowed to *regress* as far as possible. Some few of these cases must be compromised by extraction, but, even then, only one or two teeth should be removed.

According to Todd, there are three principal periods in which growth spurts are noted. The last of these periods is usually found between the sixteenth and nineteenth years. This has been rather widely accepted as true, and if extraction is contemplated, we *should* rightly wait until the patients have passed this age in nearly all cases so as not to interfere with normal stimulating growth forces.

In the last five years I have treated only three cases in which it was necessary to extract all four first premolars. In these I am not sure I was right, since the full growth to maturity has not been reached in these patients. One can always extract but, once done, there can be no retracing. After careful study of the work of others and evaluation of my own clinical experiences, I am firmly convinced that these overwhelming trends toward multiple extraction for a while, and then to the other extreme of absolutely no extraction are the *manifestations of blind groping.* Extraction has long been an "out" for poor orthodontic procedure; therefore, when it is resorted to one must be even *more careful* in considering the over-all picture. Fifty years ago, Case wrote much of treatment in which four first premolars were extracted, and in his book, published at the turn of the century, he even included pictures showing *how to attempt* and close the space and keep it closed. Even earlier, Kingsley showed a bite plane for opening and jumping the bite, made of vulcanite, which is still in extensive use today. It was also used as a retainer in extraction cases. Such treatment or philosophy is not new. I have tried always to have a middle-of-the-road attitude when the pendulum swings in one direction or the other. Even now, there is beginning a turning away from the extreme by a great number of *studious* and *careful orthodontists.*

From here I should like to turn to the joint responsibility of the orthodontist and the general practitioner in the detection and prevention of dental abnormalities. This responsibility is primarily toward children, because malocclusion must be considered in its formulative period.

One of the best methods for general practitioners to become apprised of the latest developments in dentistry is the reading of the various professional journals. This does not mean that any general practitioner would be expected to operate upon a double cleft of the palate, or to correct a complicated orthodontic deformity. It does mean, however, that every dentist should be sufficiently broadly educated to be able to recognize certain malformations and abnormalities which may be daily presented to him in his practice. If any anomaly seems to be beyond his general scope of knowledge so that he feels unable to advise that patient competently or to correct the condition personally, it is his duty and responsibility to see that the patient is referred to some specialist in orthodontics. The question of admitting and recognizing one's limitations is an important moral issue.

We must examine the patient throughout his growth and development, since there is change going on at all times. We know there is a tremendous amount of forward and downward growth of the jaws, as compared to the small amount of growth in the upper part of the skull. There are apparently rapid and slow-growth periods, although these periods vary somewhat in different individuals. These periods affect not only the teeth and jaws, but the face and the entire body as well. One thing should be very clear in the minds of orthodontists, dentists, and patients alike. Development can be given to a child only to the extent which is normal for the child at each stage of development, whether through normal growth or through orthodontic stimulation. Treatment should, therefore, be kept right in step with the development of the patient. There is no place for a "speediest" appliance in orthodontics. The common old jackscrew, with a few turns at regular intervals, is certainly capable of rapid movement, perhaps on through the alveolus. In these fluctuating growth periods, it is not advisable to have too rigid a type appliance with viselike grip on each tooth and with all locked together. Resorption of bony structure and the apical portion of the teeth is just as sure to follow such interference with normal individual function of the teeth as in any other vital part of the human anatomy so rigidly held. Such extensive root resorption is absolutely inexcusable.

When orthodontic treatment is started on the child, the orthodontist is responsible for the malocclusion. However, the child's dentist should be entirely responsible for the dental health of the patient. One of the severe criticisms of orthodontic treatment is that the appliances cause hypoplasia and decalcify certain areas of the teeth. This is indeed a serious problem and requires closest cooperation between the orthodontist, the dentist, and the patient. In the first place, the orthodontic appliances themselves do not cause decalcification or decay in teeth. As professional men with scientific backgrounds, this is a rather asinine way of explaining excessive caries to the parent. On many occasions anxious parents come in with a child in dire need of orthodontic aid and the first thing they want to know is whether orthodontic appliances cause decay.

Their friends have heard that this is true, and their dentist has affirmed the rumor. It does not raise the parents' estimation of the dentist when the orthodontist carefully explains to them that the decay is caused by acid produced by bacteria in a receptive medium, along with other associated factors. Decay is present in 95 per cent of all children's mouths, according to estimates of most researches, while probably 1 per cent or less are treated orthodontically.

If the dentist, as well as the orthodontist, would spend more time in explanation, he would be more than repaid in cooperation in treatment. The dentist should have the child in for periodic examination and prophylaxis, and not count on the orthodontist to take all the responsibility. The latter is not the specialist in this field, although he should know as much as he possibly can about it, just as the general practitioner should know as much as he possibly can about orthodontics. It is up to the orthodontist to remove the appliances at four- or five-month intervals, or oftener when necessary, but it is also up to the dentist to see that a proper checkup and prophylaxis are administered at this time. There is always the monetary consideration which is used as an excuse to avoid dental treatment in children. It has been my experience that any parent interested in having any malocclusion corrected is just as interested in retaining these teeth in the child's mouth afterwards, and he is willing to pay for that service if its importance is made clear.

The child, as a patient, has no peer if the operator will take the time well spent to gain his confidence, friendship, and cooperation. I am not speaking from an orthodontist's side of the fence in this connection. Rather, I am judging from the work I have seen done by the very best dentists in many communities. If some dentists *can* do this, then the rest *should*. Again, it must be the operator, rather than the procedure, that is at fault. Do not blame the child; blame your own inability to cope with the problem, if you are included in the group which avoids children's dentistry.

It is common knowledge that the percentage of cases with normal occlusion in the primary dentition is much higher than the percentage of those in the permanent dentition. After years of careful observation and comparative diagnosis, we cannot help but feel that this is due in a large measure to the lack of proper dental care given deciduous teeth. This should be included in a restricted sense under the classification of *preventive dentistry, and it should be practiced as such.*

In later years when these patients are seen, do not blame the orthodontist if the result is not perfect. Blame yourself, instead, for allowing the malocclusion to have developed originally. Even when the parents are noncooperative, we must shoulder a goodly portion of the blame for not having driven home to them the importance of our work.

Careful diagnosis and thorough examination are most essential in determining what the prognosis may be. Since the pediatrician, dentist, or public health official is usually the first to observe children who may need orthodontic aid, he should know some of the particular points which will assist him in recognizing such potential or present malocclusions as early as possible.

Full-mouth x-rays or roentgenograms are an invaluable aid in any thorough oral examination. No reputable orthodontist would consider treating a case without good full-mouth roentgenograms being made beforehand. Good roentgenograms, to be of any value, must project an accurate, clear image in true relationship. Bite wing roentgenograms alone will *not* suffice for they do not reveal the supporting structures of developing permanent teeth. Badly distorted ones are often worse than none since we often are misled by them. Good roentgenograms are not difficult to obtain if the principles of x-ray photography are kept in mind and applied to the object to be photographed.

Accurate models are of great aid in questionable cases, although the orthodontist will certainly make his own. Care must be taken to occlude these models correctly, or they are valueless. Models will save much embarrassment in many instances and certainly are beneficial in determining any dental treatment to be given. To determine the correct bite, we must observe closely and be sure the posterior teeth are occluding normally, since children often will protrude their mandibles so that the teeth are in an end-to-end relationship when asked to close.

Particular abnormalities, which are often overlooked, in addition to the more obvious ones, would include the following which should be noted and corrected early if possible:

a. Cross-bite Cases.—Cases which may be bilateral or unilateral with the mandibular molars in labioversion to the maxillary molars. The individual arches may appear in normal shape and no disfigurement is noted in young children.

b. Premature Loss of a Tooth.—It is easy to overlook these if the space has not already started to close.

c. Cases in Which a Tooth Is Missing and in Which the Space Has Been Entirely Lost.—These cases if overlooked in the young patients must often be compromised in some manner at an older age.

d. Cases With Very Narrow Arches and High Vault Areas.—These nearly always result in much crowding of permanent dentition unless treated early.

e. Cases With Congenitally Missing or Supernumerary Permanent Teeth, Disclosed by X-rays.—There are, of course, innumerable other individual types of malocclusions which should be diagnosed, but these are particular offenders which are not noted until disfigurement has progressed. Note again that all of these are related to preventive orthodontics. Such can be practiced on patients only when they are observed and diagnosed early, even as pit and fissure types of cavities should be.

Entirely too great a portion of all orthodontic practices consists of cases with conditions which were mainly preventable. The one outstanding cause has been the fault of the orthodontists, as well as the rest of the dental profession, and *that has been the failure to supervise intelligently and direct the proper removal or retention of the primary dentition.*

From time to time I have been asked by general practitioners what mental preparation of the patient will assist the orthodontist to best advantage in handling a referred case. I would say none. As long as you are referring the

case to someone else, do not express too many convictions about it yourself. Recommendation and consultation should be carried on between the dentist and the orthodontist, rather than giving well-meant, but occasionally ill-advised, advice to the patient. Avoid making guesses or estimates of what the orthodontist's fee will be. Common sense and sound logic should prevail in these situations, as in all others.

In conclusion I should like to say that orthodontics is not a fixed science. Like any other branch of dentistry, there are things we do not know. We shall continue, however, to seek more knowledge, not by speculation alone, *but by the more exact means of scientific investigation.* We do not expect 100 per cent success in treating malocclusion. The structure of bone in its ever-changing process of building up and tearing down with no fixed period makes perfect treatment impossible. The very function of heredity alters a certain percentage of orthodontic successes, for environmental alterations are indeed limited. On the other hand, if all the branches of the healing arts will pull together, and not separately, we shall indeed reach the golden era of *true orthodontic service.*

REFERENCES

Wood, Claude R.: Orthodontics and Pedodontics, J. Dent. Children (2nd quart.) **9**: 36-39, 1942.

Wadsworth, Frank: Mandibular Movements, Occlusion and Correlation of Orthodontia and Prosthodontia, INT. J. ORTHODONTIA **2**: 327-336, 1925.

Todd, T. Wingate: Integral Growth of the Face, INT. J. ORTHODONTIA **22**: 321-334, 1936.

Waugh, Leuman M.: The Advisability of Extractions as a Therapeutic Aid in Orthodontics: Negative, New York J. Dent. **17**: 100-106, 1947.

Case, Calvin S.: A Practical Treatise on the Technics and Principles of Dental Orthopedic and Prosthetic Correction of Cleft Palate, Chicago, 1921, Case Company.

Johnson, A. LeRoy: Basic Principles of Orthodontia, Dental Cosmos **65**: 379-389; 503-518; 596-605; 719-732; 845-861; 957-968, 1923.

Diamond, Moses: Posterior Growth of Maxilla, AM. J. ORTHODONTICS AND ORAL SURG. (Oral Surg. Sect.) **32**: 359-364, 1946.

Spencer, Paul G.: Preventive Orthodontics, AM. J. ORTHODONTICS AND ORAL SURG. (Orthodontics Sect.) **32**: 265-270, 1946.

Strang, R. H. W.: Orthodontic Problems and Information of Practical Value to the General Practitioners of Dentistry (Lecture delivered in the Extension Course for Dentists held at the University of Connecticut, May 11, 1946).

Smith, Doyle J.: When to Start Orthodontic Treatment Considering Age and Relative Growth, AM. J. ORTHODONTICS AND ORAL SURG. **33**: 36-42, 1947.

Oliver, Oren A.: The Rationale of the Labiolingual Appliances in Present-Day Orthodontic Treatment, AM. J. ORTHODONTICS AND ORAL SURG. **31**: 381-390, 1945.

Oliver, Oren A.: Some Biological and Physiological Considerations of Orthodontia and Their Relation to Some of Its Mechanical Aspects, INT. J. ORTHODONTIA **12**: 132, 1926.

Oliver, Oren A.: Certain Limitations in the Use of Appliances in Orthodontia, INT. J. ORTHODONTIA **9**: 265, 1923.

1915 BROAD STREET.

THE LENGTH OF MANDIBULAR BASAL BONE IN NORMAL OCCLUSION AND CLASS I MALOCCLUSION COMPARED TO CLASS II, DIVISION 1 MALOCCLUSION

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INTRODUCTION

THE general purpose of this study is to compare the length of the mandibular basal bone for individuals having normal dentofacial relationships (normals and Class I malocclusions) with that of individuals exhibiting a distal relationship of the mandibular arch to the maxilla (Class II, Division 1, Angle).

Orthodontic investigators and practitioners are fairly well agreed that the abnormality present in Class II, Division 1 malocclusion lies principally in the mandible. It has not been established to what extent (1) the ramus height or the basal bone length may be deficient, (2) the gonial angle may be too acute, (3) the condyle may be positioned distally to normal in the glenoid cavity, (4) the teeth may be positioned distally on the mandibular basal bone, or (5) there may be a lack of vertical growth of the temporal bone in which the condylar fossa is located. This investigation is concerned with the extent to which the observed mandibular retrusion is associated with the anteroposterior length of the mandibular body. It is for other investigators to establish the significance of the additional factors listed.

The literature on this subject reveals many references to the lack of mandibular development found in this class of malocclusion. Apparently, there has been some disagreement as to the specific center of growth which has been upset causing the retrusive position of the mandible. Angle[1] evidently considered, from his clinical observations, that it was an over-all lack of growth of the bone. He stated, "The mandible is also distal (in Class II, Division 1) in its relation to the maxilla and usually smaller than normal but quite normal in form." He did recognize exceptions to this in his last edition. This quotation is taken from the chapter, "Facial Art":

> In this class of deformities, there is occasionally noticed a type of chin characterized by a pronounced lack in the development of the mental eminence, which, since the chin is already reduced on account of the diminished size and distal position of the mandible, greatly augments the inharmony of the facial lines.

Thus, Angle must have felt that in some cases the length of the mandibular body was smaller in proportion to its other dimensions than in the normal denture. Among the others who reported examples of short mandibles was Hellman[6]

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who considered a deficient body of the mandible to be one of the principal characteristics of the Class II, Division 1 malocclusion. He wrote:

> The specific features of this Class II, Division 1 are due among other things to an underdeveloped mandible. Those features falling below normal are the ramus and body of the mandible.

Another to report cases lacking in the anteroposterior dimension of the mandible was Hemly[2]:

> In certain types of Class II, there is undoubtedly an underdevelopment of the mandible anteroposteriorly which is responsible for the improper relationship of the mandible to the rest of the cranial structures.

Both of these authors evidently reached these conclusions chiefly through clinical observations.

At least until very recently, Tweed has based his theory of treatment of Class II, Division 1 on the assumption that the mandible has not reached its normal size. In a personal communication to Strang which may be found in Strang's text,[3] *Text-Book of Orthodontia,* he questioned his treatment results in this manner:

> It seems to me that one of three things must occur in my treatment, (1) the condyle moves forward on the articularis eminentia and Nature makes a permanent adjustment in the fossa or, (2) the angles formed by the ramii and the body of the mandible become more obtuse or, (3) we actually stimulate dormant growth forces in the body of the mandible and this growth must be quite rapid. I have a feeling that the latter condition is what actually happens.

There are others who do not share these opinions, for, although they believe that a deficient mandible is sometimes associated with Class II, Division 1 malocclusion, they do not consider this condition to be characteristic of the type. Dunn,[5] in dividing Class II, Division 1 into three types, gave the following description for those includng a short mandible:

> Type three is of prenatal origin in which the body of the mandible is arrested in its anterior, posterior development as well as vertically, and attempts at correction, unless begun extremely early in life, with periods of rest over an extended time, will result in but slight improvement, most always in failure.

This statement is merely one illustration concerning the difference of opinion as to the conditions which exist in Class II, Division 1 malocclusion. The possibility of growth stimulation, which Tweed suggests as the explanation for his treatment results, is considered by Dunn as being very improbable.

Previous investigations involving mandibular basal bone length demonstrate that the mandibles in Class II, Division 1 malocclusion do not differ in the anteroposterior dimension to any significant degree from those of individuals with normal dentofacial relationships. Goldstein and Stanton[7] took measurements of children ranging in ages from two and one-half to twenty-one and one-half years and included the dimension in millimeters between menton and gonion. Their measurements were made on the median saggital plane, as a method of facial projection was used. All but the older individuals in the age

groups in their study which compare with this present work, exhibited a mentongonial dimension which averaged from 5 to 6 mm. longer in Class II, Division 1 than for those having good normal occlusion. For the children with a mean age of 15.36 years, they found mandibles of normal occlusions to average about 3 mm. longer than those of Class II, Division 1.

One of the investigations at the University of Illinois, College of Dentistry, was described by Baldridge[4] as follows:

> Adams (1939) studied the form of the mandible in one hundred eight individuals of whom fifty-four had Class I and fifty-four had Class II malocclusion. He employed an accurate radiographic technique. One of his conclusions was, "A cross section of Class I and Class II mandibles reveals no essential differences either in matter of angles or of absolute dimensions." This piece of work tends to indicate that the theory of mandibular underdevelopment in Class II malocclusion is fallacious.

This discussion has presented some of the clinical observations and research completed on mandibula body length. The purpose of the present study is to investigate further the anteroposterior dimension of the body of mandibles in Class II, Division 1 malocclusion to determine whether it is deficient compared to mandibular bodies of normals and Class I malocclusions.

PROCEDURE AND FINDINGS

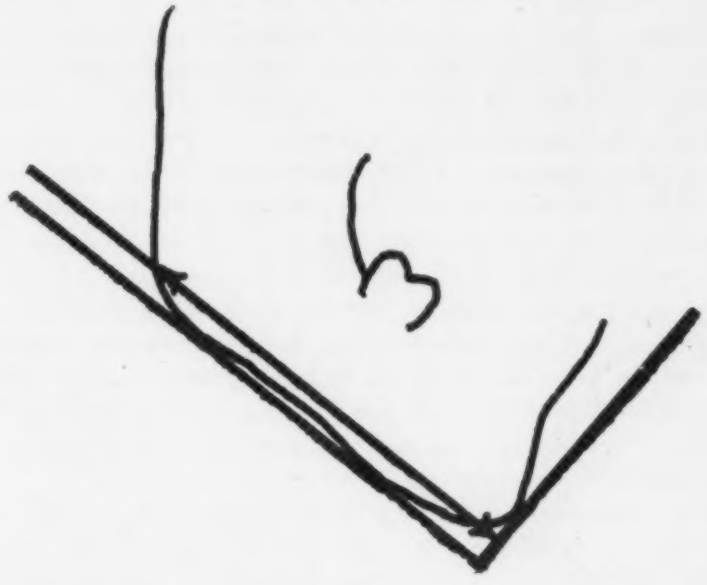
Two hundred fifty standardized profile roentgenograms obtained from the orthodontic files of the College of Dentistry, State University of Iowa, were used in the completion of this study. The roentgenograms were, for the most part, of children of professional and other higher income white families living in the vicinity of Iowa City. The ages included were 7 through 14, one hundred fifty of them being between 7 and 10 inclusive, while one hundred included the ages 11 through 14. The males and females were placed in separate groups.

The specific consideration of this study was to compare the length of the basal bone of the mandibles of individuals having normal occlusion, or Class I malocclusion, with those having a distal relationship of the mandibular denture to the maxillary denture which included only those of the Class II, Division 1 type (maxillary incisors in labial axial inclination). The normals and Class I malocclusions were placed in Group A, consisting of thirty-nine males and fifty-six females of the ages 7 through 10 and twenty males and thirty-eight females of the ages 11 through 14. Group B, or Class II, Division 1 malocclusion, numbered twenty-four males and thirty-one females of the ages 7 through 10 and nineteen males and twenty-three females 11 through 14 years of age.

Two measurements were taken of each individual in the following manner: Tracing paper with two parallel lines drawn 5 mm. apart and a third line drawn at a right angle and intersecting the parallel lines at one end was placed over each roentgenogram. The lower of the two parallel lines was placed tangent to the lower border of the mandible and the perpendicular line tangent to the menton. This automatically placed the higher of the parallel lines over that portion of the mandibular basal bone 5 mm. above the lower border of the

mandible (mandibular base line). When the roentgenograms showed two lower borders for the mandible the lowest was used for the base line and if two posterior borders of the ramus were found, the most anterior one was chosen. The distance between the perpendicular line tangent to the menton and the posterior

Fig 1.



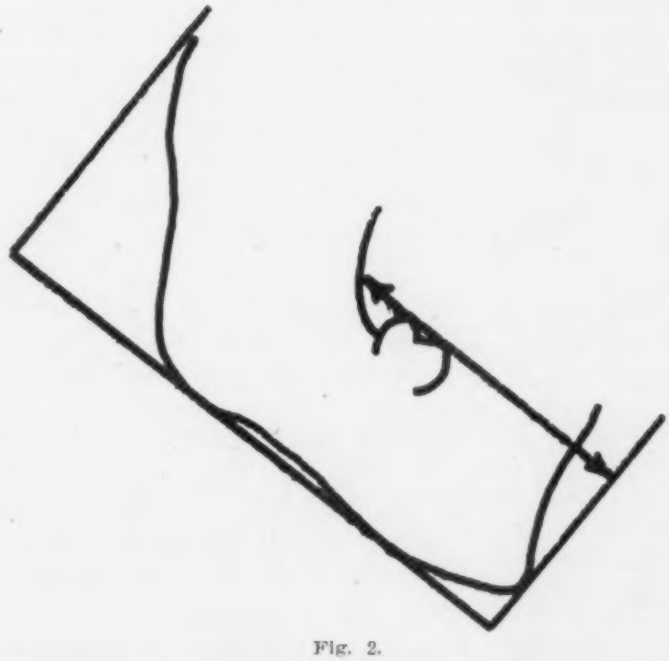


Fig. 2.

Fig. 1.—Total length of mandibular basal bone.
Fig. 2.—Length of mandibular basal bone supporting alveolar bone and teeth.

border of the ramus along the line through the basal bone of the mandible were measured and tabulated (see distance indicated by arrows in Fig. 1). The first measurement, representing the total length of the mandibular basal bone, was taken on the line arbitrarily placed 5 mm. above the mandibular base line. This allowed the measurement to be taken through points low enough to prevent the possibility of measuring alveolar bone and also eliminated a major portion of the error encountered due to the range in degrees of the angle of the mandible. An obtuse angle would tend to give a longer measurement than an acute angle, especially when taken directly on the mandibular base line.

A second measurement was made between the perpendicular and the anterior border of the ramus along a third line parallel to the mandibular base line at the occlusal level of the most posterior erupted tooth (see distance indicated by arrows in Fig. 2).

For the second measurement, representating the length of the mandibular basal bone supporting the alveolar process, the anterior border of the ramus that was most forward was chosen if two were seen in the roentgenogram as might be expected. It is, of course, questionable whether the anterior border of the ramus should be used to indicate the posterior limit of the alveolar structure in the mandible since the last erupted molar tooth is often practically covered by it as seen from a lateral view.

It must be understood that the measurements taken do not represent the actual length of the basal bone, as this curved surface is reproduced on the roentgenogram on but one plane. However, as all roentgenograms are produced in the same manner and the measurements are made by the same method, the relative values in comparing groups A and B are uniform.

All measurements were tabulated in millimeters and the mean was computed for each group as is shown in Table I.

TABLE I. CHILDREN WITH NORMAL OCCLUSION AND CLASS I OCCLUSION COMPARED WITH CHILDREN HAVING CLASS II, DIVISION 1 MALOCCLUSION

	MALES				FEMALES			
	AGED 7-10		AGED 11-14		AGED 7-10		AGED 11-14	
GROUP	N	MEAN	N	MEAN	N	MEAN	N	MEAN
	Total length of mandibular basal bone							
A	39	73.6	20	76.1	56	72.0	38	75.1
B	24	71.0	19	73.3	31	71.5	23	72.5
	Length of mandibular basal bone supporting alveolus							
A	39	55.4	20	57.1	56	53.0	38	57.0
B	24	51.7	19	53.0	31	52.2	23	54.0

Considering first the total length of the mandibular basal bone, the mean for males 7 to 10 years of age is 73.6 mm. in Group A and 71.0 mm. in Group B. For ages 11 to 14 years, the means are 76.1 mm. in Group A and 73.3 mm. in Group B. There is a reliable difference between Groups A and B for the period 7 to 10 years (t=2.7)*. For the period 11 to 14 years, the difference is not clearly dependable (t=1.6).

*The *t*-test is a test of statistical significance. For samples of the size used in this study, a *t* value of 2.7 indicates a highly dependable difference—a difference that would not be expected to arise by chance more than once in a hundred experiments. Values for *t* of 2.3 to 2.0 indicate differences that are fairly reliable—differences that would not be expected to arise by chance more than two (t = 2.3) to five (t = 2.0) times in one hundred experiments.

Turning to females, the mean 7 to 10 years for Group A is 72.0 mm., for Group B 71.5 mm. Corresponding means 11 to 14 years are 75.1 mm. and 72.5 mm., respectively. As for males the differences are consistently in the direction of Group A being larger than Group B. Tests of significance show the difference is not substantial at 7 to 10 years (t=0.5), but is highly reliable at 11 to 14 years (t=2.5).

The second measurement, representing the length of basal bone supporting alveolar structures, gives a mean for males 7 to 10 years of 55.4 mm. on Group A and 51.7 mm. on Group B. Means at 11 to 14 years are 57.1 mm. for Group A and 53.0 mm. for Group B. In both age periods the difference is in the same direction (Group A larger than Group B) and is statistically dependable (t=3.2 for 7 to 10 years, 2.0 for 11 to 14 years).

For the females, in the age span 7 to 10 years, the means are 53.0 mm. in Group A and 52.2 mm. in Group B. For the ages 11 to 14, Group A has a mean of 57.0 mm. and Group B of 54.0 mm. The difference is in a like direction for both groups, but is statistically significant only for the later age span (for 7 to 10 years, t=0.9, for 11 to 14 years, 2.5).

TABLE II. MANDIBULAR BASAL BONE LENGTH

GROUP		NUMBER OF CASES	INTERQUARTILE ZONE	RANGE
A				
Ages:	7-10	95	69.5-75.0	61.0-84.0
	11-14	58	72.5-78.0	67.5-92.0
B				
Ages:	7-10	55	68.0-74.0	65.5-76.0
	11-14	42	71.0-76.0	61.5-82.5

TABLE III. LENGTH OF MANDIBULAR BASAL BONE SUPPORTING ALVEOLAR PROCESS

GROUP		NUMBER OF CASES	INTERQUARTILE ZONE	RANGE
A				
Ages:	7-10	95	51.0-58.0	44.0-65 5
	11-14	58	53.0-61.0	50.0-72.0
B				
Ages:	7-10	55	49.5-55.0	45.0-59.0
	11-14	42	51.5-58.0	45.0-62.0

On the whole the males of Group A are found to be reliably larger than the males of Group B in both dimensions. For females, reliable differences are obtained in the 11 to 14 age span but not in the 7 to 10 age span.

As a matter of supplementary information, the individuals of both sexes were combined into Groups A and B with the range and interquartile computed. The first measurement had a range from 61.0 mm. to 84.0 mm. and an interquartile zone from 69.5 mm. to 75.0 mm. in Group A and a range of 65.5 mm. to 76.0 mm. and an interquartile zone of 68.0 mm. to 74.0 mm. in Group B of children 7 to 10 years of age. For the ages 11 to 14, the range was 67.5 mm. to 92.0 mm. and the interquartile zone, 72.5 mm. to 78.0 mm. in Group A with the range in Group B being 61.5 mm. to 82.5 mm., while the interquartile zone was 71.0 mm. to 76.0 mm.

The second measurement of the 7- to 10-year-old children presented a range of 44.0 mm. to 65.5 mm. and an interquartile zone of 51.0 mm. to 58.0 mm. in Group A and a range of 45.0 mm. to 59.0 mm. and an interquartile zone of 49.5 mm. to 55.0 mm. in Group B. For the older group the range was 50.0 mm. to 72.0 mm. and the interquartile zone from 53.0 mm. to 61.0 mm. in Group A and the range 45.0 mm. to 62.0 mm. and the interquartile zone from 51.5 mm. to 58.0 mm. in Group B.

SUMMARY AND CONCLUSIONS

Two hundred fifty standardized profile roentgenograms were measured in this study and of these, one hundred fifty-three belonged to Group A (normals and Class I malocclusions) and ninety-seven belonged to Group B (Class II Division 1 malocclusion). These roentgenograms were obtained from the orthodontic files of the College of Dentistry, State University of Iowa.

Two measurements were made on each roentgenogram and were expressed in millimeters. The measurement expressing the total length of basal bone of the mandible was made from a line perpendicular to the mandibular base line and tangent to the menton distally to the posterior border of the ramus along a line 5 mm. above and parallel to the mandibular base line. The second measurement expressing the length of the basal bone immediately beneath the alveolar bone surrounding the teeth was made from the same perpendicular line distally to the anterior border of the ramus along a line parallel to the mandibular base line at the occlusal height of the most posterior erupted tooth.

After these measurements had been made and tabulated, there was evidenced a greater length of basal bone in normals and Class I malocclusions than in Class II, Division 1 malocclusions. Tests of significance confirm this in every grouping except those of females 7 to 10 years of age.

The data obtained from this study do indicate a greater length of mandibular basal bone in normal occlusion and Class I malocclusion than in Class II, Division 1 malocclusion, but the small amount of difference in actual figures denotes a questionable etiological significance. The figures representing the means and medians do not, except in one grouping, differ by more than 2.8 mm. The results of this study do not reject the ideas of those who contend that the mandible is inhibited in growth in Class II, Division 1 malocclusion, for there is a dimensional difference in the length of the basal bone in the two groupings. This difference is so small, however, that its etiological significance is questioned. An examination of the range and interquartile zones in this study substantiates this conclusion, for the minimum values in the range are very close being larger in Group B in the 7 to 10 age grouping. The greatest difference can be seen in the maximum values which are almost 10 mm. longer in Group A than in Group B, indicating a number of exceptionally long mandibles in Group A. The interquartile zones are almost identical in the two groupings, which, plus the great differences in maximum values, indicates that the means might be even closer were it not for these few large mandibles which are found in Group A and not in Group B. Thus, although we do not find the basal bone in the mandible of

the Class II malocclusion to be exceptionally long in as many cases as that of the normal and Class I groupings yet the minimum range and the average are very near equal in both groups. However, these small differences, together with growth deficiences in the other dimensions could, undoubtedly, result in a factor of etiological significance. The additional factors mentioned at the beginning of this study possibly combine with growth discrepancies to cause the mandibular retrusion found in these cases. As a single factor, however, mandibular basal bone length would not seem to be extremely important in a very high percentage of Class II, Division 1 malocclusions.

REFERENCES

1. Angle, Edward H.: Treatment of Malocclusion of the Teeth, Philadelphia, 1907, The S. S. White Dental Manufacturing Company.
2. Hemly, Samuel: Fundamentals of Occlusion, Philadelphia and London, 1944, W. B. Saunders Company.
3. Strang, Robert H. W.: A Text-Book of Orthodontia, Philadelphia, 1943, Lea & Febiger.
4. Baldridge, J. P.: A Study of the Relation of the Maxillary First Permanent Molars to the Face in Class I and Class II Malocclusions, Angle Orthodontist **11**: 100-109, 1941.
5. Dunn, Robert: The Great Problem in Malocclusion of Teeth of Types of Class II, INT. J. ORTHODONTIA **17**: 675-687, 1931.
6. Hellman, Milo: The Face and Occlusion of the Teeth in Man, INT. J. ORTHODONTIA **13**: 921-945, 1927.
7. Goldstein, Marcus S., and Stanton, Frederick L.: Facial Growth in Relation to Dental Occlusion, INT. J. ORTHODONTIA **23**: 859-892, 1937.

In Memoriam

CHARLES HENRY JUVET

1875-1948

THE city of Ottawa and, indeed, Canada lost one of its outstanding dentists April 8 in the passing away of Charles Henry Juvet.

After graduation from the Royal College of Dental Surgeons at Toronto, Dr. Juvet began practicing in Ottawa, the city in which he was born. After three years of general practice, he became interested in Orthodontics, which he practiced as a specialty until the time of his retirement through illness three years ago. Few men have had a longer experience in orthodontics or a finer career than Dr. Juvet had.

He was well known and respected, not only by those who were fortunate enough to be his patients, but by members of the profession in both Canada and the United States.

Dr. Juvet was a past president of the Ottawa Dental Society and the Eastern Ontario Dental Association. He became a member of the American Association of Orthodontists in 1913. He was a member of the Anglican Church, a member of the Masonic Order, Civil Service Lodge A. F. and A. M. of Ottawa, a former member of Rivermead Gold Club and the Canadian Club, and he also belonged to the Order of Odd Fellows and the Canadian Order of Foresters.

He had a great love for fishing and canoeing and spent his summers beside the beautiful lake at Algonquin Park. He was always interested in and liked to help the younger man, and no doubt many were impressed with his straightforwardness and true sense of ethics.

Dr. Juvet is survived by his widow, one son, a daughter, and two grandchildren.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

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A History of Scientific English: By Edmund Andrews, M.D. Pp. ix + 342. Illustrated. Price $7.50. New York, R. Smith, 1947.

In his foreword to this book, Arno Luckhardt of the University of Chicago states that after a perusal of the first few chapters of the text he felt a fascinaion which impelled him to continue. This reviewer can agree with Professor Luckhardt in every detail. Andrews traces the changes which have occurred in Indo-European philology. He shows the Aryan heritage in Greek and Latin, the development of the romance languages and of German and English. Dental nomenclature being what it is, this book could well serve as a text for those who would undertake to bring order out of chaos in the language of our profession.

This is more than a tome on the development of biomedical terminology. It is a fascinating account of how the various languages of the world came about. For the dentist there is special delight in learning the origin of words which he uses daily in his practice. For example, the word "amalgam," we learn, is a corruption for "malagma," Greek for "a soft mass." The names of neighboring organs in the body are shown to have the same origin. Thus, for example, the Indo-European root meaning "to grind or crush" has given the word for "jaw" in various tongues. The German "maul" (mouth) and the English compound of "mylo-" have the same origin. Changes in meaning of the same word root are common in various parts of the face and jaws. Thus, the word "wange" in German means "cheek" while "fang" in English, which is of the same derivation, means "tooth." "Bucca" means "cheek" while "bouche" means "mouth." "Mentum" in Latin means "chin"; "mund" in German of the same derivation means "mouth." The word "anesthesia," which is accepted as an invention of Oliver Wendel Holmes, is shown to have been used by Plato.

The value of precise nomenclature is shown by the author, who points out that previous to the time when the BNA suppressed other systems, students of medicine had to learn two or more names for every one of thousands of internal organs. He presents a set of rules for the formation of a simple nomenclature. The philology of nomenclature is shown to be not as important as was formerly supposed because, as a matter of fact, words carrying Latinized and Greek names were not thus named by the Latins and Greeks but by scientists who tried to continue fashions set by early writers who transcribed the original names found in old manuscripts. A considerable group of sciences has practically abolished nomenclature entirely. Examples are mathematics and physics, which have developed the use of symbols to such an extent that their actual specialized vocabulary is quite small. In contrast to the foregoing, the author points out that the nomenclature of the entire group of biologic sciences presents an appalling hodgepodge.

As to the future, Andrews is convinced that basic English can be adapted for scientific purposes so that the 500 millions who know English, no matter how slight, can learn to read the scientific language in a few days.

J. A. SALZMANN.

Collier's Year Book, 1947. Covering events of the year 1946. Prepared by leading authorities under the supervision of Charles P. Barry, Sc. B.; Ll. B.; Ll. M., Year Book Editor, 1947. Pp. xv + 700. With many contemporary illustrations. New York, P. Collier and Son, Corporation.

This volume presents the progress made in various fields during the first postwar year. Full accounts are given of the United Nations Meetings in New York and the peace conferences in Europe. On the home front, such events as the removal of price controls and labor unrest are given due consideration.

In the section on dentistry we are informed of the gross inadequacies in the distribution of the number of Negro dentists in the United States. The glaring example of Dallas, Texas is shown, with only one Negro dentist to 10,000 population, while Jacksonville, Florida, goes Dallas one better with one Negro dentist in 15,000 population. Other topics discussed are the number and distribution of dentists in general, the release of dental veterans, distribution of surplus dental materials, hospital dental care in clinics, the safety of nitrous-oxide, and other current topics. This book makes excellent reception room reading.

Clinical Dental Roentgenology (Technique and interpretation, including roentgenographic studies of the child and the young adult): By John Oppie McCall, D.D.S., F.A.C.D., Former Director, The Murry and Leonie Guggenheim Dental Clinic; Formerly Professor of Periodontia, New York University College of Dentistry; Visiting Lecturer in Periodontia, New York University College of Dentistry; Consultant to the Dental Services, New York Hospital; Associate in Public Health and Preventive Medicine, Cornell University College of Medicine; Formerly Lieutenant Commander (Dental Corps) United States Naval Reserve; and Samuel Stanley Ward, D.D.S., F.A.C.D., Assistant Professor of Roentgenology, New York University College of Dentistry; Lecturer in Dental Radiology, New York University College of Medicine, Formerly Head of the Department of Diagnosis and Roentgenology, the Murry and Leonie Guggenheim Dental Clinic and School for Dental Hygienists; Special Lecturer in Roentgenology and Oral Diagnosis, U. S. Naval Dental School, Naval Medical Center, Bethesda, Md., Consultant in Charge of Roentgenology and Oral Diagnosis, Dental Clinics of the Community Service Society of New York; Captain (Dental Corps), U. S. Naval Reserve. Pp. xvi + 343. With 1,180 illustrations and 415 figures. Ed. 2, Philadelphia and London, 1947. W. B. Saunders Company.

In the second edition the authors have included many commonly found bone dysplasias and tumors of the jaws not discussed in the first edition. Special emphasis has been placed on differential diagnosis. Separate chapters are now presented on cysts, bone dysplasias, and tumors of the jaws. Interesting material is included on the effects of radiation on dentists and dental x-ray technicians and measures to be taken for the safety of the dentist as well as of the patient. The excellence of the illustrations in the first edition has been maintained.

This is an excellent manual on dental roentgenology in which the authors are not content merely to present methods of obtaining roentgenograms but stress

instead interpretation and differential diagnosis. An interesting chapter is the one on the localization of misplaced teeth, cysts, salivary calculi, and foreign bodies. Dentists will find here a practical manual of outstanding value.

Essentials of Endocrinology: By Arthur Grollman, Ph.D., M.D., F.A.D.P., Professor of Medicine and Chairman of the Department of Experimental Medicine, the Southwestern Medical College; Attending Physician and Consultant in Endocrinology, the Parkland Hospital, Dallas, Texas. Ed. 2, revised and enlarged. Pp. xxiii + 644. With 132 illustrations. Philadelphia, London, Montreal, J. B. Lippincott Company, 1947.

Grollman approaches endocrinology on the basis of its scientific background rather than in purely clinical concepts. The clinical aspects of endocrinology are even today far from being fully established. Many of the former clinical criteria have been discarded with the establishment of factual scientific experiments which revealed the inaccuracy of the formerly accepted clinical symptoms. Teeth as a diagnostic factor in the endocrinopathies have come in for their share of attention. It is now generally recognized, however, that while disturbances in eruption are frequently pathognomonic of endocrine disbalance, the size and number of the teeth may or may not be associated with endocrine disturbances. Thus, in hypophysectomized animals the deciduous teeth are not lost. In some endocrinopathies the teeth suffer because of changes in their environment or because of generalized ectodermal dysplasias. This is true in parathyroid insufficiencies where the blood calcium is reduced. However, to claim that tooth size and shape are influenced by the endocrines is to enter the realm of conjecture.

In the chapter on the physiology of the anterior lobe of the hypophysis we are informed that the course of skeletal growth is determined primarily genetically but that growth may be retarded by any disorder which interferes with the health of the organism and may be modified by hormonal factors. These dicta emphasize the importance of postnatal environmental, including pathologic, factors on the manifestation of the growth pattern.

News and Notes

Central Section of the American Association of Orthodontists

The regular annual meeting of the Central Section of the American Association of Orthodontists will be held Oct. 25 and 26, 1948, at the Corn Husker Hotel, Lincoln, Nebraska.

Great Lakes Society of Orthodontists

The Nineteenth Annual Meeting of the Great Lakes Society of Orthodontists will be held Oct. 18 and 19, 1948, at Hotel Statler in Cleveland, Ohio.

Dr. F. Copeland Shelden, Dr. Ashley E. Howes, Dr. B. Holly Broadbent, and Dr. Samuel Chase will be the essayists.

Table clinics will be presented. Time for fellowship is essential to all outstanding meetings. Please make your hotel reservations in ample time. We do not want you to be inconvenienced.

Southern Society of Orthodontists

The Southern Society of Orthodontists will hold its annual meeting Oct. 11, 12, and 13, 1948, at Hotel Peabody, Memphis, Tennessee.

European Orthodontic Society

The dates of the meeting of the European Orthodontic Society have been changed to Friday, Saturday, and Monday, July 16, 17, and 19, 1948. The change was made for the convenience of European colleagues and because of the meeting of the American Dental Society of Europe, which will be the following Monday, July 26. It is hoped that many American friends and colleagues will be able to attend.

Inquiries should be sent to the Honorary Secretary,

Mr. L. Russell Marsh
19, Harcourt House,
19, Cavendish Square,
London, W. 1.

or to the Honorary Treasurer,

Dr. O. Henry
11B, Portland Place,
London, W.1.

Northwestern University Graduate Orthodontic Seminar

The following program was presented at the Second Northwestern University Graduate Orthodontic Seminar, May 3 and 4, 1948.

Bone and Bones. Dr. Harry Sicher, Professor of Histology and Anatomy of Loyola University and Guest Lecturer in Graduate Department of Orthodontia, Northwestern University Dental School.

Guiding Alveolar Growth and Eruption of Teeth to Reduce Treatment Time and Produce a More Balanced Denture and Face. Dr. Silas J. Kloehn, Appleton, Wisconsin.

Case Analysis and Treatment Planning Based Upon the Relationship of the Tooth Material to Its Supporting Bone. Dr. Ashley E. Howes, New Rochelle, New York.

The Technic of Closing Spaces in Extraction Cases. Dr. F. Copeland Shelden, Kansas City, Missouri.

Case Analysis and Treatment Planning. Dr. John R. Thompson.

Each participant will bring a transparent millimeter ruler, protractor, and pencil for measuring mimeographed tracings of cephalometric x-rays of the cases under discussion.

Results of the Application of Intermaxillary Force. Dr. Ashley E. Howes, New Rochelle, New York.

Patient Management. Dr. Silas J. Kloehn, Appleton, Wisconsin.

Twenty-five patients under treatment in the Department of Orthodontics. Presented by the staff and graduate students with complete case analysis and treatment plans. The patients will be present for examination by the Seminar participants.

Demonstration Clinics—each clinic to be repeated three times:

1. Technic of Closing Spaces. Dr. F. Copeland Shelden.

2. Appliances and Mechanics Used in Guiding Growth and Eruption. Dr. Silas J. Kloehn.

3. Technic of Tracing and Evaluating Cephalometric X-rays. Dr. John R. Thompson.

A Surgical Approach to the Cleft Palate and Lip Patient That Does Not Inhibit Facial Growth. Dr. Wayne B. Slaughter, Chicago. Discussion, Dr. T. M. Graber.

Certificates Granted by the American Board of Orthodontics, April, 1948

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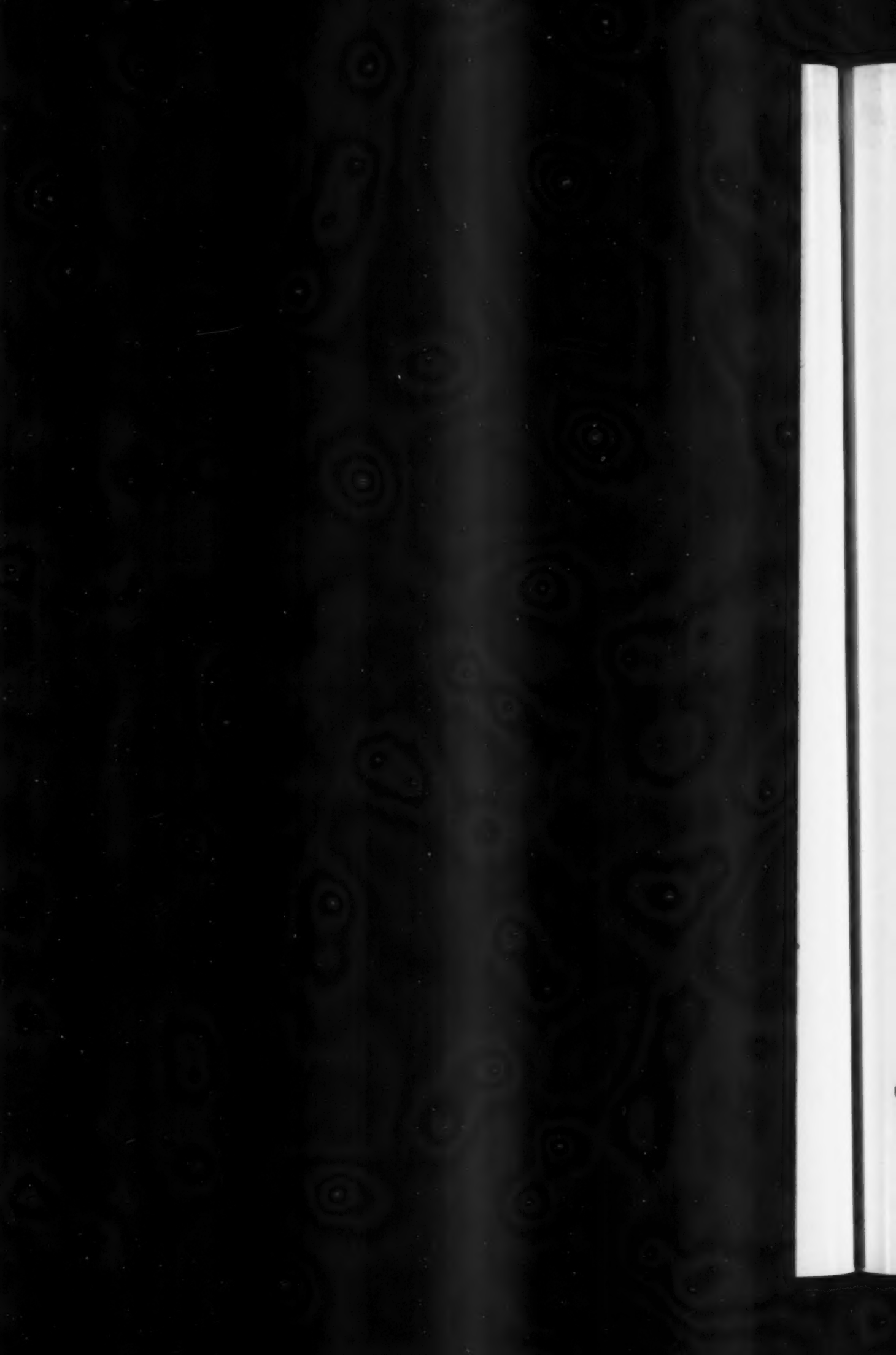

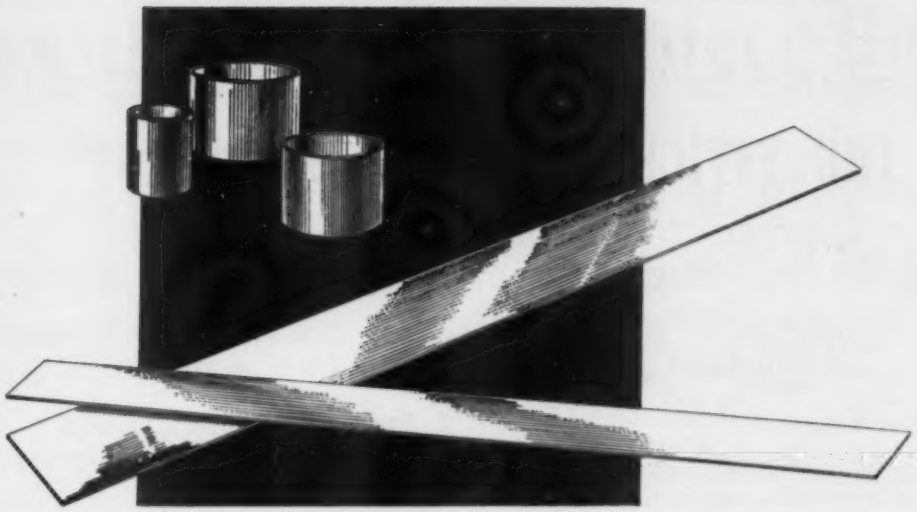

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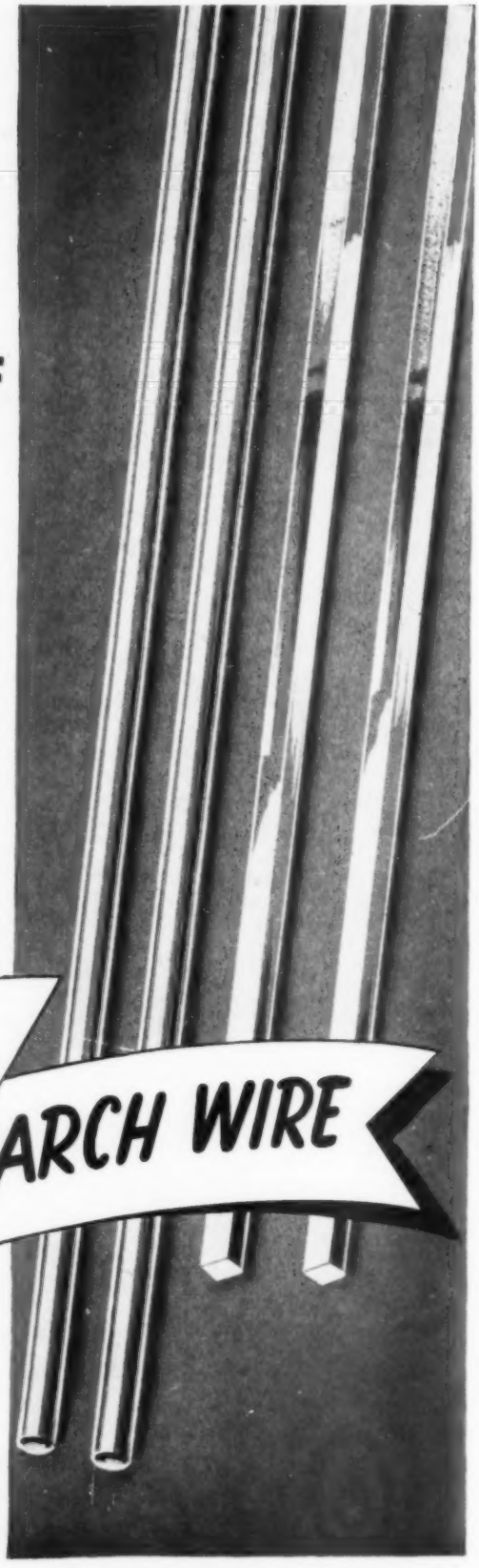

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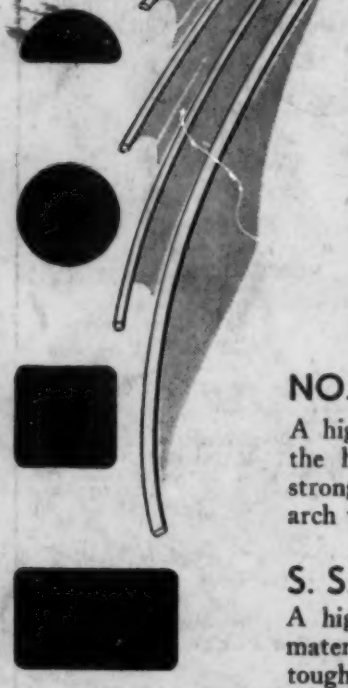

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